THE
ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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A REVIEW OF THE ELECTRICAL INDUSTRY.

THE comprehensive address with which Sir John Snell inaugurated his occupancy of the presidential chair of the I.E.E. cannot be said to be lacking in breadth of view, or in affording abundant scope for comment. We cannot hope in the space at our command to deal with more than a few of the many points arising out of his remarks; but we may say that, as a whole, the address leaves the impression that the new President is inspired with a spirit of optimism, zeal and devotion to the interests of the industry of which he is now at the head in this country.

Sir John remarked that it was difficult to write an address without invading the region of controversy, and it can hardly be said that he was successful in avoiding this danger, though nothing that he said could be regarded as provocative in any way. His complimentary allusions to the Incorporated Municipal Electrical Association were well deserved, and remind us that the Association's influence bids fair to rival that of the Institution; as a body it is certainly in close touch with mundane affairs, and is free from the charge of having its head in the clouds, an accusation which is often levelled at the older Institution. That it should be more coherent and homogeneous is the necessary consequence of its constitution; on the other hand, there is no inherent reason why the members of the Institution should not pull together better, placing the common welfare above their individual interests. A former President strove earnestly to bring about this most desirable consummation, and we have no doubt that Sir John Snell will aim at the same goal, though it is a thankless task—for, of all people, electrical engineers seem least able to grasp the true significance of loyal co-operation.

A reference to the late Industrial Committee was unavoidable, and here the President was treading on thin ice. He adopted the position that the existence of separate representative bodies for the different sections of the industry was inevitable and even salutary—a perfectly reasonable attitude, within limits. How difficult it is, however, to maintain a sound position with regard to this question is well illustrated by the President's own remarks. For instance, he said that "to give decisions on controversial subjects affecting two sections of the industry which may happen to be opposed in their views must necessarily involve serious, and sometimes insuperable, difficulties"; yet in the next paragraph he said that the Institution must be prepared to arbitrate between them. Again, Sir John said that the Institution had to consider electrical progress as a whole, while each Association had its own particular sectional interest to advance, and he cited a hypothetical case of the B.E.A.M.A. opposing the introduction of some improved design of machine, while the I.E.E., desirous of advancing electrical interests generally, "would be rightly expected to encourage any such improvement." That is precisely where

the scheme breaks down; past experience tells us with rigid certainty that the Council of the Institution would discreetly murmur ponderous platitudes about taking such action in respect of industrial matters as might conduce to the general advancement of electricity and its applications, and giving full consideration to any representations, &c.—and would fold its hands and do nothing. The Council is mortally afraid of "taking sides"; it cannot act judicially, for fear of the wrath of the party adjudged to be in the wrong, so, like Justice only in this one respect, it blindfolds its eyes.

The President's suggestion that a standing Advisory Committee should be formed is interesting, in that it so accurately follows the career of the unfortunate Committee that was snuffed out by the Council. "Suppose a difficulty were to arise between two sectional Associations, and suppose the Council were invited to compose the difficulty. The Advisory Committee would again invite certain members fully experienced in the subject in dispute to join them. . . . Conferences with both parties would be held . . . . a fair compromise would be arranged or a direct report made to the Council that some definite attitude should be adopted by them"—so far so good; it is a beaten track. But—"The ultimate power to act must of course rest with the Council, who clearly cannot delegate their powers and responsibilities to another body." Exit the Ind—Advisory Committee.

We are glad to see that Sir John warmly espouses the cause of the ill-paid junior members of the profession, who, having an association of their own, are now becoming articulate and will increase in strength and influence as time goes on. Their cause is just, and ought not to have had to wait for recognition till the time approached when they could compel it. It has been pleaded many times in our columns. Sir John's appeal to heads of departments—with whom it rests to bring about reform, and upon whom rests the shame—is well timed and well expressed. The I.M.E.A. in this respect heartlessly abdicated its position as a body representing the municipal branch of the profession.

The admirable response of the electrical engineers to the call of their country has been abundantly manifested in our pages, and we need only endorse the President's praise and his sure confidence that they will do their duty and reflect credit upon their profession.

The President, referring to the opposition of the Electrical Contractors' Association to the Electric Lighting Bill, assumes towards it the same attitude as we have adopted—namely, that their action is contrary both to the public interest and to the interests of the contractors themselves; and he also advocates a reasonable compromise.

Turning to technical matters, Sir John says he is unwilling to discuss the question of bulk supply controversially, and will deal only with what he thinks are facts. There is a terrible suggestion here as to what he would do if he did enter into controversy—but the matter is too delicate for further comment! We perceive, with dismay, that we have as yet turned over only half the pages of the address, and while there are many inviting topics in the remaining moiety, we must defer consideration of them to another occasion.

In Darkest London.

A number of articles are appearing as to the wisdom or otherwise of the present arrangements for artificial lighting in the metropolis and other important cities, a peculiarity about the matter which has not attracted attention is that the whole responsibility for regulating the lighting rests with the police, and thus very largely with individual constables who patrol the streets. Now the questions arising as to sufficiency or insufficiency of illumination, glare or its antithesis, are not simple matters which can be mastered in a day (or a night) by a layman whose educational qualifications are not his strong point; we have seen constables drilling in the early days of their career, we have read of constables being complimented by experienced K.C.'s on the rapid way in which they decide to act or not to act on the spur of the moment where some abstract reading of the law is the determining factor, but we can hardly imagine that any members of the force have studied the subject of artificial illumination—suddenly thrust upon them—in sufficient detail to ensure election to, say, the Illuminating Engineering Society. Moreover, individual constables are not granted the use of discretion, and therefore they attempt to apply, as far as their intelligence enables them to do, the interpretation of the Commissioner's order to all parts of the Metropolitan Police area—from Potter's Bar to Purley, and from Staines to Gravesend—regardless of circumstances, regardless of weather conditions, regardless of the citizens' comforts and prejudices. Perhaps a more co-ordinate system might be arrived at if the Chief Commissioner had at his disposal the assistance of some men with knowledge and experience of the Metropolis and of the subject being dealt with. No doubt abundant assistance would be forthcoming if an application were made through the learned societies, or a batch of special constables enrolled to deal with the problem under a more carefully-planned scheme, drawn up under favourable conditions, than it can have been possible for the police to work out under the pressure of their ordinary duties.

We are by no means inclined to belittle the importance of the matter—rather we consider it far too important a matter for the police (unaided) to handle; a Zeppelin load of explosives (say about two tons) distributed over London, would quickly convince the people of London that there are inconveniences even greater than those caused by subdued artificial illumination.

More About the Russians.

In our last issue we quoted some observations by one of His Majesty's Consuls in Russia on the reasons for German success in connection with the machinery trade of that vast country, and in obtaining contracts for electric lighting, tramway, and other public works for municipal authorities. We are quite sure that the advice contained in the report will receive all the attention that it deserves at the hands of any British electrical firms or organisations who take an interest in the possibilities of the Russian market, and we hope that it will assist them in the preparation of plans that may be contemplated. We have so often drawn our readers' attention to the vastness of this field, that it is almost needless to refer further to the matter now, beyond suggesting that our previous comments might be read again with some profit. The name of M. Basilé de Timiriazeff, President of the Russo-British Chamber of Commerce in Petrograd, is not unfamiliar in these pages, for we have quoted his words before to show the readiness of Russia to increase trading relations with us. We are not sure whether it was M. Timiriazeff—we think

it was—who tried to make us understand that Warsaw so much desired British goods in preference to all others that German firms made it their business to purchase here and sell in Warsaw. Warsaw has been very much in our minds lately—it was in the mind of the Kaiser until ten days or so ago as winter quarters for the Crown Prince's army. If Warsaw showed the above preference for British manufactures before the war, and would have dealt direct with us had proper facilities been in existence, what will be the feeling of the people now? We trust British firms will remember such points as these and note how great will be the desire in many places to deal first hand with us in the future instead of through the medium of present enemies. M. de Timiriazeff has sent to England a letter, which has been published in some of the daily papers, drawing attention to the "altogether exceptional conditions which now obtain for English trade with Russia, and which promise to continue for some time to come, and the desirability of co-operative action in both the countries concerned." He refers to the enormous gap created at this time of rapid economic development by the "almost wholesale withdrawal of German trade from Russia." "*The change has brought us in Russia face to face with an entirely new position.*" His Chamber of Commerce is receiving requests from all sides for assistance in the establishment of trade relations in every branch with Great Britain, and Committees have been appointed to deal with many questions arising out of the present position. Though their work is partly occasioned by the prevailing special war conditions, they aim at providing a permanent basis for normal times. "The question," he continues, "is all the more urgent because of the immediate annulment of the Commercial Treaties of Russia with Germany and Austro-Hungary, so that at the end of the war it will be necessary to revise and establish on a new basis the whole international commercial policy of Russia." The language difficulty, to which we have alluded on previous occasions, is mentioned by the writer, and he hopes that it may be possible to develop on both sides the facilities for acquiring the languages and the special knowledge necessary for Anglo-Russian trade. We quote one further sentence:—

I am at one with many public men in Russia in thinking that economic co-operation is one of the strongest bonds of friendship; and in the case of England and Russia, where the question is not one of commercial rivalry but of mutual supply, this consideration has a special force.

We hope that British electrical and engineering firms who have in the past treated Russia as a market in which it was impossible for them to do great things in presence of the machinations of German financial industrial organisations, with Russian electrical concessions slipping into German hands, and with German electrical factories existing in several Russian centres, will take a more hopeful view of the situation.

Clearly it is not the English engineer who is inefficient, for, as we reported a few years ago, there were so many of our engineers in authoritative posts in Russia, that even the Russians themselves instituted an inquiry to find out the reasons for the preference. Nor is it British manufactures that are at fault. It seems to be little else than a case of success due to Germany being on the spot with the most competent representatives commercially, technically, and linguistically, backed with strong financial ability which enabled large operations to be conducted, including the setting up of manufactories—the last named being, we believe, a stipulation imposed by the Russian Government. Whatever may result from the new position which M. Timiriazeff says now faces the country, we must at the moment anticipate that Germany will not lack equally competent representatives in her export markets. She may—we think will—be crippled financially, and it seems fairly certain that neither the Russian Government, the Russian municipalities, nor the Russian people, will be anxious to deal with German works or financiers if Britain, Belgium, or France can anyhow manage to meet their requirements.

Rubber. The market has had a firmer tendency since last writing, and the unfettered activities of the German cruiser *Emden* and the sinking by her of the *Troilus* with a large cargo of rubber on board, have had no small influence in determining the course of values. The latest escapade of this boat at Penang will certainly not add to the confidence of shippers and shipowners in the effective patrol of the seas in Eastern waters by the Allied Powers, and people are beginning to wonder when we are going to have a "go" at some of these German freebooters. There can be no security on the Eastern trade route till the position is cleared up. Leading Eastern ship owners have intimated that their vessels will not run in the infested waters till the *Emden* is accounted for. The price of rubber for November and December delivery is very firmly held as the result of the shipping position, and buyers in hopes of the stiffness being only temporary, are holding back as long as may be possible, but there are several influences operating to prevent the rapid handling of consignments arriving from the East. It is a matter of general knowledge that Germany is beginning to get short of rubber, and it is interesting to note that rubber and also motor tires are now on the absolute contraband list issued by the Government within the last few days. This is a direct blow aimed at Germany's great fleets of motor vehicles, and there is not the smallest doubt that a rubber famine would do much to reduce the efficiency of transport of the Huns, who have been making desperate efforts to procure the necessary supplies from neutral ports and countries. It is even stated that America has been shipping rubber freely in Dutch, Italian and Scandinavian liners, from New York, with the intention that it should be transhipped to Germany. We can only put an end to this state of things by exercising all our rights at sea, and we have no doubt now got a man at the head of affairs who will have no scruples in doing what war demands. These are not the days for mealy-mouthed respect for the feelings of people who are out to assist our enemies. Hence it is to be hoped that the most rigorous supervision will forthwith be undertaken for the purpose of ensuring that no material whatever likely to be of use in prolonging the war shall be permitted to reach Germany. The closing of the North Sea is a step in the right direction.

The position of supplies from Malaya is shown in the following official statement of exports for the nine months ended with September:—

	1912.	1913.	1914.	
January	253	784	1,181	tons.
February	274	743	1,703	„
March	427	898	1,285	„
April	387	762	1,548	„
May	431	814	1,309	„
June	398	812	1,480	„
July	380	1,120	1,584	„
August	729	1,315	1,325	„
September	597	1,057	1,602	„
Total	3,876	8,305	13,017	„

The F.M.S. output of plantation rubber for last year is given officially as 23,719 tons against 15,506 tons in 1912, this being about 50 per cent. of the world's supply, which is returned as 47,000 tons. The total estate production of Malaya is, however, given as 28,214 tons, an increase of 9,266 tons on the previous year. The largest increase outside of the F.M.S. came from Malacca. The area planted in rubber during last year was only 34,127 acres, compared with 54,105 acres in 1912, and 107,200 acres in 1911. This increase is, however, larger than might have been expected under the circumstances.

D

THE GOVERNMENT ELECTRIC POWER STATION OF BANGKOK.

By FRANCIS B. SHAW, A.M.Inst.C.E., A.M.I.E.E., Electrical Engineer to the Government of Siam.

Introduction.—In view of the great strides that electricity has made throughout the Far East, a short account of the municipal power station in Bangkok, Siam, may be of interest.

At the present time there are two power stations in Bangkok. The first, owned by the Siam Electricity Co., Ltd., is situated at Wat Liep, about 300 metres from the river. This station was started in November, 1899, but previously to this electric tramways were in use in Bangkok, supplied from another small station, which was closed when the Wat Liep station started.

The second station is the Government electric power station in the Samsen district, and is situated in a favourable position near the river. The primary reason for this station being built was that the waterworks pumping station then being built required a considerable amount of electric power. This could have been supplied by the Siam Electricity Co., Ltd., but their station was at a considerable distance, and it would have been an expensive transmission line to construct. Further, it was considered that electricity could be produced at a much lower cost by a modern station situated on the banks of the River Menam, and at a point fairly close to the waterworks. A further advantage was to be gained by having the waterworks and the power station under one authority.

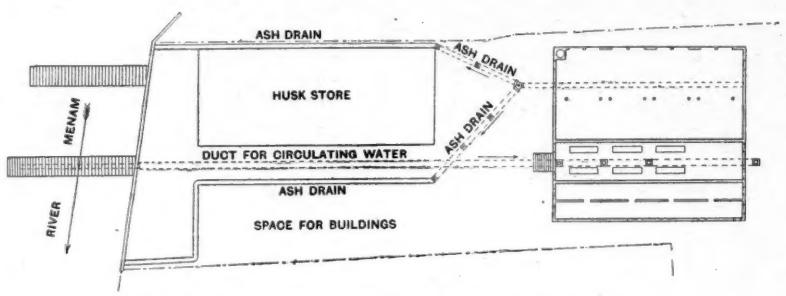


Fig. 1.—Bangkok Electricity Works: Plan of Site.

Site and District of Supply.—The site chosen for the power station is the nearest point on the river to the waterworks pumping station, and is also within a short distance of a district in which the consumption of energy, both for lighting and power, has increased by very rapid strides during the last few years, and there is every indication that the increase will be maintained. Consequently, it was decided to put down a station to supply the whole of this district. It is hoped to obtain a very good load factor, since the power load is, if anything, slightly in excess of the lighting load. The load is made up as follows:—

Day Load.—Waterworks pumping station, full load during the day, and 25 per cent. load during the night. Opium farm, day load only. Cement factory, full day load, with a continuous load of 50 per cent. full load during the whole of the 24 hours. In addition, a small load from fans and small pumps.

Night Load.—A large lighting load nearly equal to the above day load, together with the night power load, as already stated.

Fuel.—Siam is a large producer of rice, and in Bangkok alone there is a large number of rice mills. Large quantities of rice husk are produced in the processes of milling. A certain amount of this is used by the mills to produce the power they require, but there is always a considerable surplus. In appearance it closely resembles the husk of wheat; it is a very bulky fuel, and its usefulness is very much affected by its being wet or dry.

The following figures relating to the calorific value of paddy husk were supplied by the assayer to the Royal Mint, Bangkok. They were obtained from an ordinary sample of husk:—

Loss at 100° C. (moisture), 8 per cent.

Weight per unit volume of paddy husk: From 7·2 to 7·9 lb. per cb. ft, depending on whether the husk is shaken during filling or not.

Ash (inorganic residue on ignition): In moist husk, 19·3 per cent.; in dry husk, 21 per cent.

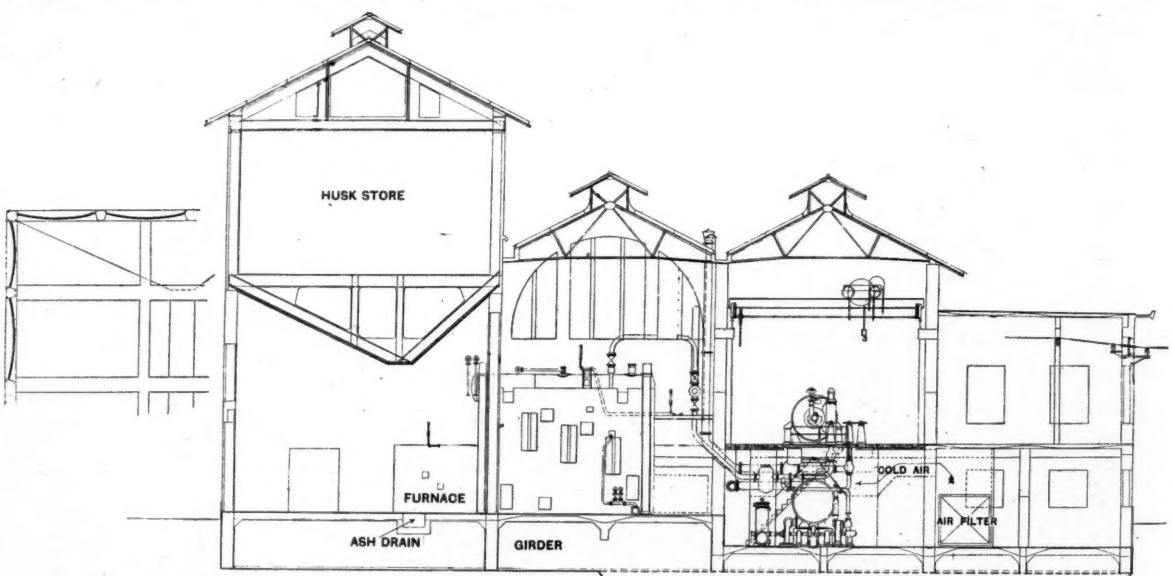


Fig. 2.—Sectional Elevation of Power Station Buildings.

Calorific power (by Thomsen's calorimeter): (*a*) Dry paddy husk: 1 gramme on complete combustion will produce 3,850 gramme calories. (*b*) Paddy husk as received (moist): 3,766.

Evaporative power: (*a*) Dry paddy husk: 1 lb. on complete combustion will evaporate 7·17 lb. of water at 100° C. to form steam at 100° C. (*b*) Paddy husk as received (moist): 7·01.

These figures point out the advantage of using dried husk. If the paddy husk is very wet it is of no use as a fuel.

The supply of rice husk falls off during three months of

the year—October, November, and December—as very little rice comes down to Bangkok during those months.

For this reason we have arranged to store as much as possible, and have a large store for paddy only, between the station and the river: the store over the boiler house is sufficient for 10 days' continuous steaming on half the full load of the station. Further, to provide against a total failure of husk fuel, we have a store of liquid fuel between the husk store and the station. Three connections to the supply pipe line are on each wharf, and a motor-driven oil pump takes the oil through these from the oil-tank barges and delivers it to the oil tank. Since it was impossible to place this oil tank in any other position, and a fire at this point might be serious, a special arrangement for the use of live steam has been adopted.

Both husk stores have a complete system of Grinnell fire extinguishers, supplied in the first instance by two tanks on the top of the husk store over the boiler house, and partly under pressure from a 75-B.H.P. motor-driven fire pump, by Messrs. Mather & Platt. This pump is housed in a small shed near the filter well in the supply culvert, and takes its supply of water from the latter. Fire mains run round the compound, and hydrants are situated at each corner of the two main buildings.

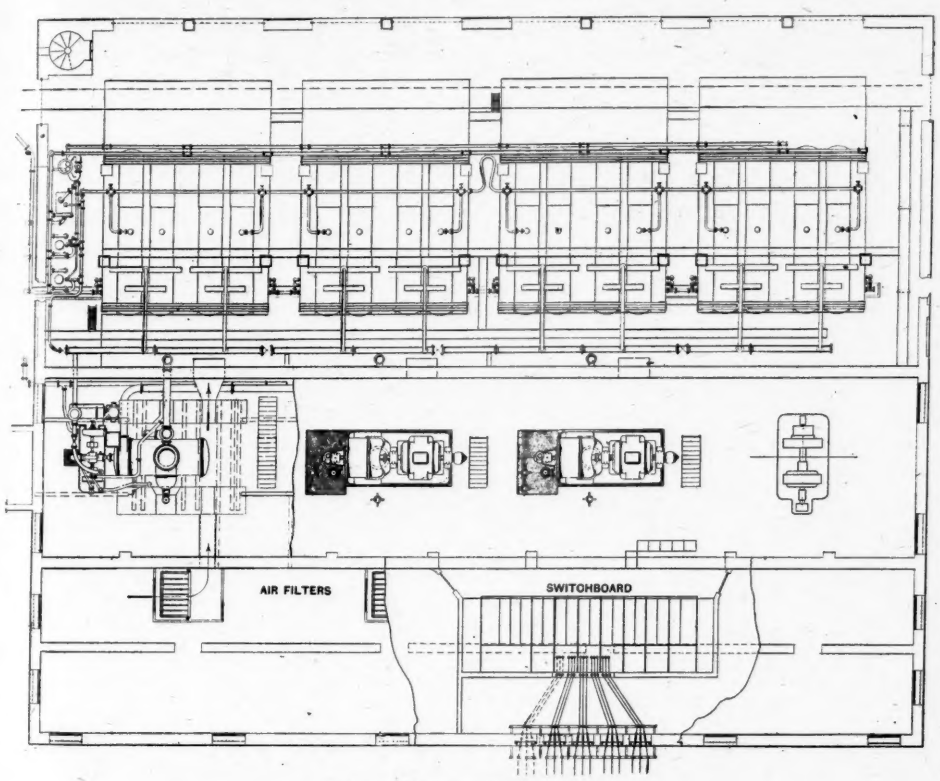


Fig. 3.—Plan of Power Station.

Returning to the question of husk fuel, one of the chief problems was the efficient conveying of so bulky a substance. Conveyors have been installed of the Archimedean screw type, and although this system has been in vogue for a long time and has been used for conveying husk horizontally, for inclined conveyors of so large a diameter it is rather a novelty.

Rice husk, although so light, is yet found to be very abrasive, and many types of conveyors that have proved quite successful with other material have failed when used for husk. This specially applies to conveyors of the suction type.

The four conveyors were supplied by the New Conveyor Co., Ltd.; they are all of the screw type and of 3 ft. diameter, but differ in that the inclined conveyors, Nos. 1 and 3, are of complete spirals, *i.e.*, enclosed to the shaft, whereas the horizontal spirals are only 4-in. ribbons attached by driving arms to the shaft. Of course at bearing points the screw is broken, but the husk heaps up slightly at this point and flows over to the next spiral and thus forward.

A teak wharf about 80 ft. long carries the hopper end of No. 1 conveyor, the husk being emptied into this hopper from the boats alongside the wharf. The upper end of this conveyor is anchored to the end wall of the husk store, and is driven through worm gearing by a 10-H.P. motor. From this point the husk is delivered into No. 2 conveyor, which is a U-shaped trough with a 4-in. deep ribbon spiral of 3 ft. diameter revolving in it. This conveyor is placed horizontally along the top of the husk store and supported by ferro-concrete pillars. At intervals of 10 ft. there are doors fitted to the bottom of the trough for the purpose of discharging the paddy husk into the store as desired.

At the end of this conveyor there is a discharge shoot similar to that on No. 1 for discharging into No. 3 conveyor, and at this point a platform is combined with the end wall to carry the 10-H.P. motor for driving this section.

No. 3 conveyor is 150 ft. long, and being inclined is of similar construction to No. 1, being carried on a lattice girder bridge. Its lower end rests on the floor of the husk store, and its upper end is attached to the end wall of the boiler house at a height of 55 ft. from the ground level. At this point it is driven by a 10-H.P. motor through worm gearing.

About halfway up its length No. 2 conveyor discharges into No. 3 conveyor through a shoot, in which case only the top half of No. 3 conveyor is required, and the lower half is disconnected by means of a clutch. When, however, it is required to take husk from the store to the store over the boiler house, then the whole length of No 3 conveyor is used, and the husk enters through a hopper with regulating slide at the lower end. A tunnel is provided under No. 3 conveyor inside the husk store for regulating this slide and oiling the thrust and shaft bearings.

The thrust is taken by Hoffmann ball bearings, and so far no trouble has been experienced with them. The speed of all four conveyors has been kept down to 60 revolutions a minute, in order to avoid excessive wear. At this speed the guaranteed output is 250 cb. m. an hour.

No. 4 conveyor is similar in all respects to No. 2 conveyor, and is placed horizontally over the boiler hoppers, any of which may be filled by opening the corresponding door under the conveyor. The boilers beneath are arranged in four banks, each half-bank having its separate hopper and shoot. The capacity of these hoppers and the store is about 7,000 cb. m.

The method adopted in feeding the boiler furnaces from the hoppers consists of a simple arrangement of cones and shutters, whereby the supply of husk may be regulated as the demands for steam arise.

The husk store is constructed of half-brick horizontal arches between ferro-concrete pillars, the arches being so constructed as to transmit the thrust of the husk outwards on to these pillars when the store is full (see detail, fig. 2).

Water Supply.—From the foregoing description it will be seen that the husk store is between the power station and the river bank; this, while obviating the necessity for conveying the husk over the boiler house to the store and back again from the store as required, is for yet another reason.

Owing to the nature of the ground, which is no more than a sea of liquid mud under a sun-dried crust about 1 m. thick, the question of foundations was a most serious one, and it was deemed advisable to place the power station as far from the river as practicable.

For this reason, and in order to avoid a long suction-pipe line or auxiliary pumps on the river bank, it was decided, first of all, to construct a culvert right from the river and underneath the site of the turbine and condenser room of the power station. This culvert, of cross-section 1 m. × 1·25 m. deep, terminates near its river end in a circular well in which the filter screens are placed. There are two filter screens, the lower half being of heavy iron-wire netting and the top half of punched metal plate. These screens run in teak wood guides, and are raised for cleaning and lowered by means of a pulley block and jib.

From the filter well to the river the supply is by an iron pipe supported from the main wharf, the top of the pipe being 4 in. below the lowest known tide. From the filter well to the power station the culvert is given a downward slope of 1½ m, and it is carried to a point beyond the station, where it terminates in another well from which certain auxiliary pumps take their supply. The culvert may be closed at the river filter well and pumped dry from this end well for inspecting and cleaning.

The condensers for the three turbo-generators take their supply from uptakes from this culvert inside the station.

It is hoped that by reason of the slope on the culvert there will be less liability for mud to interfere with the action of the foot valves, &c., of the circulating pumps, as the river water contains a lot of matter in suspension, and that the requisite flow of water at low tides will be maintained sufficient for full load. For a similar reason the filter well has been made considerably deeper than the culvert, to allow any deposit to settle at this point. It would have been a very difficult and expensive matter to construct the culvert at any greater depth at the river end, owing to the porous nature of the ground and the increased pressure of the water at high tides.

Regarding the wharves and husk store, provision has been left for adding a similar store and wharf on the down-stream side.

Power Station Building.—As previously mentioned, great care had to be taken regarding the foundations of this building, and a network of ferro-concrete beams, the chief of which are 2·20 m. in depth, carries the main raft or platform; one of these massive girders is shown in fig. 2. This platform is at ground-level for the boiler house, but is brought down to 1·20 m. below ground level for the floor of the basement of the turbine room, air filter room and store room. This portion has been very carefully lined with bituminous sheeting, and a reinforced layer of cement has been placed over it.

The ground was more than usually bad owing to there being several canals or ditches cutting across the site. So far, however, no serious subsidence has taken place, although the building has been completed for more than a year.

The system above-mentioned of horizontal arches in half-brick with ferro-concrete pillars is used for the husk store over the boiler house, and the sloping floor of this is constructed of ferro-concrete. This is probably one of the first instances of hoppers of this type being constructed entirely in ferro-concrete—certainly it is in the East. Three doors give access to the turbine room from passageways between the four banks of boilers. The turbine room had to be reduced in width as much as possible, as the land available for the station was very much restricted in width. Consequently it was decided to place the three turbines lengthwise to the boiler house.

Large windows at each end give ample light, and even under tropical conditions the room remains comparatively cool, all steam pipes being kept below the turbine floor in the basement. The overhead travelling crane runs on rails on ferro-concrete girders the length of the building. The switchboard is set back slightly, and the back is enclosed in a brick chamber, entrance being by two doors of expanded metal. To the right of the switchboard is the battery room, and to the left the engineer's office and meter testing room. Below these, corresponding to the condenser room, are the air filter and store rooms. A motor-generator is placed at the end of the turbine room farthest from the river.

(To be continued.)

THE ELECTRICAL TRADES AND THE WAR.

(Continued from page 583.)

LITHOLITE, LTD.

All the questions are answered in the affirmative, except that a little difficulty is experienced in obtaining an adequate supply of labour.

E. BROOK, LTD.

We have sufficient orders to keep our works fully employed, and up to the present have found no difficulty in obtaining the labour necessary. New orders are coming in at a satisfactory rate, and we have been fortunate in securing several orders which had formerly been placed with Continental firms, but no orders that we can trace that have been previously placed with neutral countries.

We are getting all the raw material we require, and the financial conditions are such as to enable us to accept orders freely, but we are sorry to say there are quite a great number of firms hiding behind the moratorium.

We are starting to manufacture several articles that have previously been purchased from other firms and abroad.

MAWDSLEY'S, LTD.

Orders.—We have experienced no falling-off whatever in orders since the war broke out, and have sufficient in hand to keep our works running full time.

Labour.—We have experienced some difficulty in obtaining this, as something like 16 per cent. of our staff and employés have joined the Colours in one capacity or another.

New Orders.—These appear to be coming in quite as freely as before the war, and with regard to new business which formerly went to Continental firms, we have received a number of inquiries from firms who were previously buying German material, some of which have matured, and we anticipate that when exchange difficulties disappear there will be a considerable influx of business from this source, from abroad and the Colonies.

Re Materials.—We have found no difficulty whatever in filling our requirements.

Financial Conditions.—With the exception of the question of the foreign exchanges, these, as far as we are concerned, are quite satisfactory.

New Lines.—We have been, and are, so well placed at present as regards standard lines, that, especially in view of the difficulties in obtaining labour, we have not entered into any extensions in this respect.

THE EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD.

1. We have at the present moment, and have had ever since the war started, sufficient orders to keep our works fully occupied. In fact, as previously reported, we have for some weeks had to take on extra labour.
2. Whilst the supply of labour in our locality offered some difficulty at the onset of the war, things are improving daily.
3. Yes, quite satisfactory to everyone.
4. We are getting new business and inquiries from the Colonies and our Continental Allies.
5. The supply of raw material is naturally somewhat restricted, but in no way has it, so far, seriously inconvenienced us.
6. No complaint regarding financial conditions.
7. We hope eventually to put on the market lines of manufacture which were previously peculiar to the Continent, but at the present time we are quite busy enough with all our usual "All-British" products. If things continue as at present, we shall have to extend even further than is being done to meet immediate demands.

METALLIC SEAMLESS TUBE CO., LTD.

We have sufficient orders in hand to keep our works fully employed, although our staffs are depleted considerably owing to a great number having joined the Forces.

Re Supply of Labour.—This at the moment is rather a sore point with us, but we are glad to say that we are gradually overcoming this.

Re New Orders.—Orders are coming in very satisfactorily at the moment, and in many lines, the demands are really greater than the supply.

Re New Business.—We are pleased to say that we are getting new business, which formerly went to Continental firms, from our Allies and the British Empire.

Supply of Raw Material.—We are pleased to say that at the moment the supplies of raw materials are sufficient for our requirements, although prices fluctuate considerably.

Financial Conditions.—We are meeting this in the spirit which we hope the whole of the trade will admit is for the benefit of the country, inasmuch as we are giving, in many instances, extended

credit to allow our customers an opportunity of overcoming financial difficulties where possible.

Starting New Lines of Manufacture.—We are starting to manufacture new lines, formerly dealt with only by Continental firms.

We do not think that we can make any comments upon the replies, but we might mention that we are experiencing considerable difficulty in getting English manufacturers to fall into line to compete with Continental materials; this is particularly so in the glass trade, the replies that we get being that the expense in putting down plant to compete would not be compensated, the fear being that if the war was to end suddenly, the country would be flooded with the present Continental stocks.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

B.T.H. Ironclad Switchgear.

The British Thomson-Houston Co., of Rugby, has recently developed a special line of three-phase oil switchgear for mining and industrial work, on the "draw-out" principle—the various parts, switch, instruments, &c., being mounted on a sliding carriage and connected to the bus-bars or cables through plug contacts.

The gear is provided with all the ordinary attachments, and some novel combinations of automatic devices to meet different requirements of service.

The switches have two ratings, 120 and 500 amperes for up to 650 volts, and 50 and 120 amperes for up to 3,300 volts. On withdrawing the switch and removing the oil tank, the contacts, delaying devices, overload adjusting devices and fuses are fully accessible; by taking out four screws the contents of the switch body can be removed in one piece; and removal of a back cover gives access to the connection chamber. The switches can be mounted on common pedestals and coupled to common bus-bars.

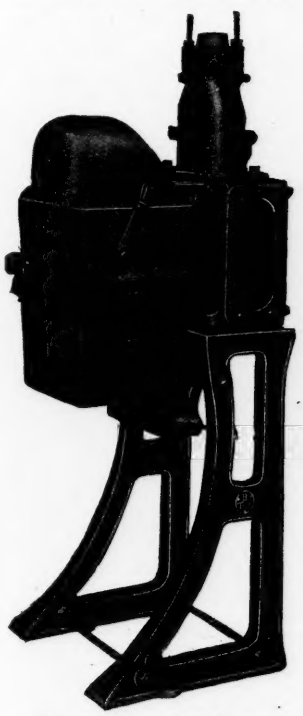


Fig. 2.—Draw-out Switch with Ammeter Hood on Pedestal.

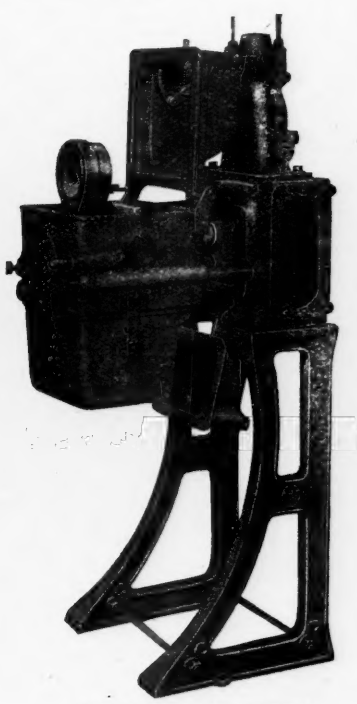


Fig. 3.—Switch, showing Carriage Withdrawn and Cover Open.

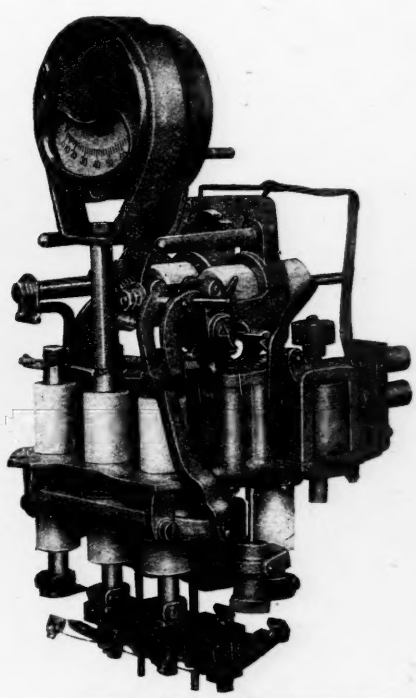


Fig. 4.—Switch Mechanism with Ammeter, Fuses, Low-voltage Release, and Slow-motion Starting Attachment.

B.T.H. Ironclad Switchgear.

Interlocks and catches are provided to ensure safety when withdrawing or inspecting the switch, and the latter is closed and opened through independent toggles and trips free of the handle. The tripping device is of the dash-pot type with a suitable delaying action.

The cable connecting boxes can be mounted on the top, bottom or sides of either size of switch, and suitable connections are provided for coupling up to the cable armouring or lead.

Continuity of the earth connection is ensured by the large flanged joints of the castings, but it is desirable, where necessary to meet Home Office requirements, to use the usual copper bonds between armouring of incoming and outgoing cables.

By means of the company's patent electrical interlock, these switches can be interlocked with motor starters and controllers, the connection being made by means of a flexible armoured conductor with a plug contact for insertion in the side of the oil switch.

Full particulars of these switches are contained in list No. 4,160.

Simplex Dimmer Fittings.

Messrs. Simplex Conduits, Ltd, of 116, Charing Cross Road, W.C., are now supplying a line of fittings in which a dimming

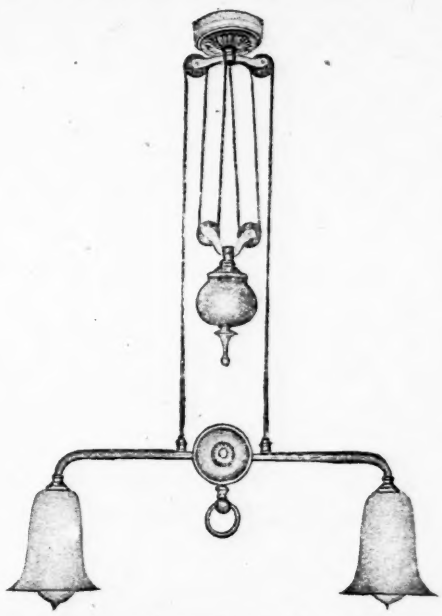


Fig. 1.—Simplex Pendant with Dimming Switch.

effect is not obtained by the insertion of resistance in series with the lamps, and consequent waste of current.

In the pendant shown in fig. 1, a patent switch is fitted in the body, by means of which it is possible to have (1) both lamps on full; (2) one lamp on full; (3) both lamps dim; (4) both lamps off.

The current consumption is in direct proportion to the light emitted at any time.

These fittings are supplied in brass or copper, polished or bronzed, in the pendant or wall patterns.

Copes Feed-Water Regulator.

The above-named regulator for boiler feed-water, which has achieved a considerable success in the United States, is now being introduced to this country by Messrs. Scholey & Co., Ltd., of Queen Victoria Street, E.C., who have acquired the English rights. A notable feature of the device is that it is based upon the principle

of a variable water level, the latter being maintained at the upper limit during light load periods, so that the boiler stores the maximum amount of water and heat, and the level being allowed to fall, when a heavy load comes on, to the lower limit. Thus, when the demand for steam is pressing, the heat of the furnace is utilised only for evaporating water, and not for heating cold feed. When the water level reaches the prescribed lower limit, the regulator increases the rate of feed until it is equal to the rate of evaporation, thus maintaining the water level.

The regulator, which is shown in fig. 5, is entirely outside the boiler, and consists of an inclined special metal expansion tube supported by heavy angle-iron base and an upright fork so as to form a triangle. The upright fork acts as a fulcrum for a bell-crank lever, which magnifies the motion of the expansion tube. Openings are provided in the fittings at the ends of the tube for the pipe connections to the boiler. Two stiff braces with a triangle base to the expansion tube strengthen the latter and prevent buckling. The lever of the thermostat is connected by a vertical chain or a stiff strut to the lever of a control valve of the balanced type. It will be seen, therefore, that the regulator is of the thermostatic tube type

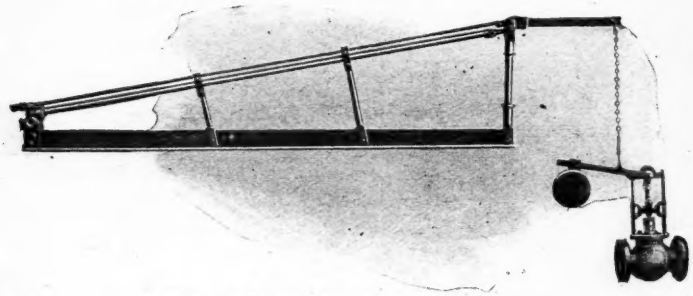


Fig. 5.—Copes Feed water Regulator.

Previously all such types of instrument have sought to maintain constant water level, which the makers of the Cope's regulator consider to be entirely wrong from the point of view of a variable load.

Fig. 6 diagrammatically represents the arrangement of the regulator. The maximum and minimum heights at which it is deemed safe to carry the water levels are first decided upon, and then the thermostat is installed with sufficient slope so that when the water level is at its minimum height there is no water in the expansion tube, and when the level is at the maximum height, the tube is filled with water. When in service the level is between these extremes, and the expansion tube is partially filled with

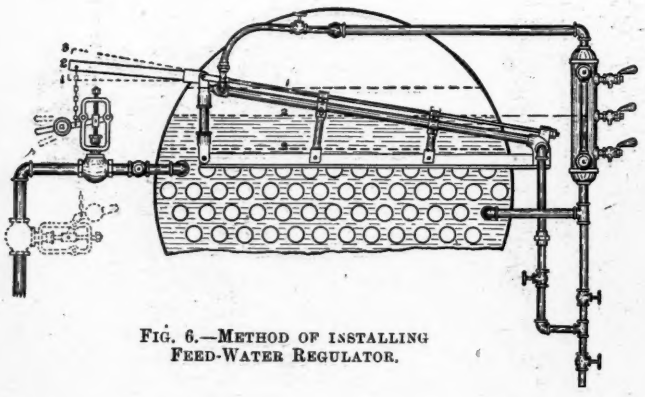


Fig. 6.—Method of installing Feed-Water Regulator.

water. The level in the tube fluctuates with the level in the boiler. The part of the expansion tube filled with steam is maintained at the temperature of the steam, since as fast as it radiates heat it causes condensation and the liberation of latent heat at steam temperature.

On the other hand, the lower part of the thermostat is at some temperature below steam temperature, since the radiation of heat from this part of the tube can only take place at the expense of the sensible heat of the water. When the water is at its minimum level and the thermostat is filled with steam, the metal is at the highest temperature, and expands to its greatest length; when it is filled with water it contracts to its shortest length. This length, and the feed valve opening operated thereby, thus varies with the amount of water in the tube and the height of the water in the boiler.

When an increased load comes on, the first thing that happens is a slight drop in steam pressure, accompanied by a more rapid liberation of steam from the entire body of water within the boiler, which causes a corresponding increase in its volume, and a rise in the boiler water level. This at once slightly raises the level of the water in the expansion tube, decreases its temperature and causes it to shorten, decreasing the rate of feed to the boiler.

As the heavy load continues, the evaporation of water causes the level to drop, and this in turn causes expansion of the thermostat and gradual opening of the feed valve. The level in the boiler drops and the feed valve opens until a point is reached where the rate of feed equals the rate of evaporation and equilibrium is restored, the water being at a new level. In the case of a decrease in load the converse takes place.

Every load on the boiler has some corresponding proper water level which the regulator maintains.

"Comfy" Electric Fire.

The Attracta Electrical Co., of 75, Fetter Lane, E.C., have introduced an electric fire for use in small rooms, offices, &c., which is shown in fig. 7. This consists of a polished copper case

Fig. 7.—The "Comfy" Electric Fire.

with a 500-watt rod heating element arranged horizontally in the best position for radiating the heat rays. This apparatus is portable and can be used from a lampholder; a larger size containing two such elements is also supplied.

Carron Cooking Apparatus.

Through the courtesy of the Carron Co., of Carron, N.B., we are able to illustrate some recent examples of electric cooking apparatus introduced by them.

Grillers and toasters for hotel and restaurant use are supplied in five different sizes, and can be built up in sets of two or three

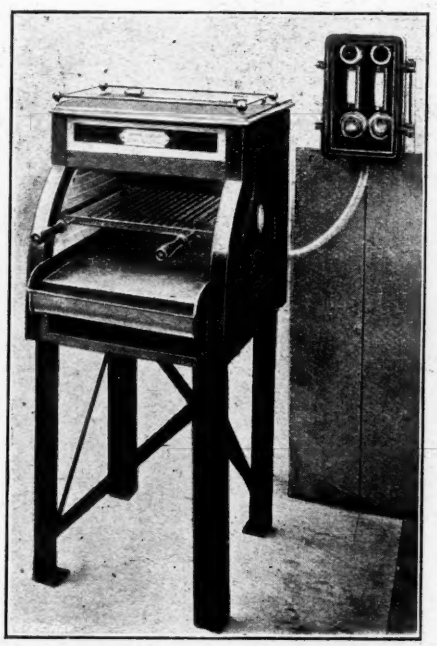


Fig. 8.—Ship's Electric Grill.

when required. The smallest size is loaded up to 5 kw., and fitted with indicating switch control for various temperatures.

A development of this type specially designed for use on ships, where strength and utility are of prime importance, is shown in fig. 8.

This apparatus is built up of heavy steel plates and the connections are carried to the switches, fuses and pilot lights, which are enclosed in a special cast-iron water-tight box. The latter is white porcelain enamelled throughout, and fitted with a substantial

glass door. The gravy tin and well are of copper, well tinned. Standard Carron heating elements are fitted, and the griller shown is loaded to 5 KW.

Fig. 9 shows a double oven range, in which type four sizes of ovens are available.

The loading of the ovens ranges from 3,000 to 3,500 watts; four hot plates are fitted—a 6-in. (500 watts), two 8-in. (1,000 watts),

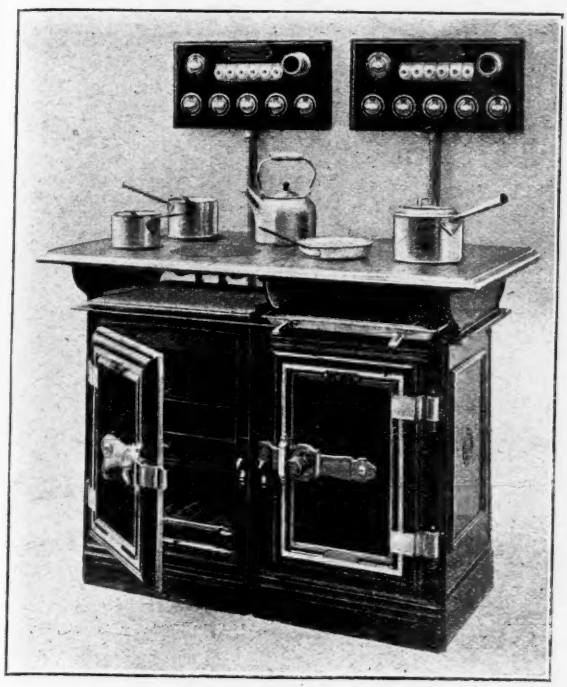


Fig. 9.—Double Electric Oven Range.

and a 10-in. (1,600 watts), also a 22 in. × 14-in. grill (3,000 watts). All the heating elements are separately controlled by special indicating switches giving various degrees of temperature, and each circuit is supplied through a Zed fuse and pilot light, all of which are mounted on a separate switchboard.

A further view, fig. 10, shows a hot closet and carving table with a polished top and copper water bath underneath the hob, fitted with a draw-off cock.

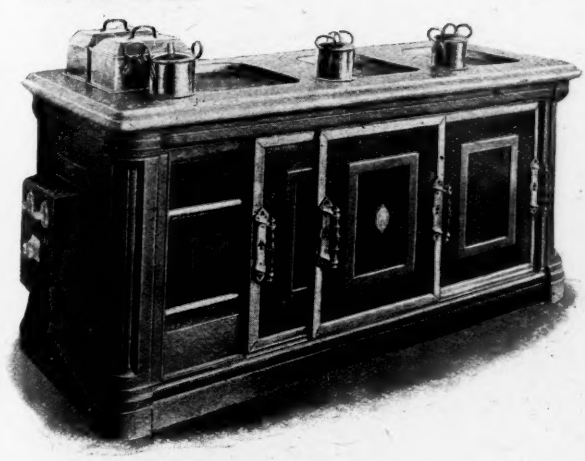


Fig. 10.—Electric Hot-Closet and Carving Table.

The hob is fitted with three carving recesses, also gravy wells and vegetable warmers, these being made of heavy-gauge copper, tinned inside.

Sliding doors are provided to the cupboard, which is fitted with adjustable grid shelves, and top and bottom are independently heated and controlled.

The maximum loading, 7·5 KW., can be reduced to 750 watts.

"Woolwich" Tape (Improved Type).

Messrs. Siemens Brothers & Co., Ltd., Woolwich, London, S.E., are placing an improved type of "Woolwich" tape on the market, superseding the "Woolwich" tape which for a number of years has been widely used. The improved type is manufactured of a very fine quality fabric entirely free from pinholes, and is expected to give even more satisfaction than the old type. Samples will be forwarded to electrical contractors on request.

LEGAL.

Nottingham Corporation *v.* H. W. Cox.

At Nottingham County Court on October 28th, before Judge Allen, an action was heard in which the Nottingham Corporation sued Mr. H. W. Cox, of Park Row, claiming 9s. 6d. as the cost of a terminal box and an electric line at defendant's house.

Mr. J. Williams (Town Clerk's department) was for the plaintiffs, and Mr. A. M. Bramall (London) defended.

On behalf of the Corporation, Mr. Williams said they based their claim on the Nottingham Electric Lighting Order, 1900. It was not a question of the amount, he explained, but of the principle involved.

Mr. H. J. Talbot, the Corporation's electrical engineer, said the charges had been paid by all consumers hitherto.

Mr. Bramall's case was that the terminal box was to prevent excess of supply, and for the protection of the mains, and not of the consumer. He urged that the consumer should not have to pay for its installation, and that Nottingham was the only large town in the country which made such a charge.

His Honour reserved judgment.

The Attorney-General at the relation of Long Eaton Gas Co. *v.* Long Eaton Urban District Council.

This case came before the Court of Appeal, composed of the Master of the Rolls and Lords Justices Kennedy and Swinfen Eady on Thursday, October 29th, upon the appeal of the defendants from a judgment of Mr. Justice Sargant in the Chancery Division, the question raised being whether local authorities, companies and persons authorised to supply electricity had power to give preferences to some of their customers.

By the action the Attorney-General, on the relation of the Gas Co, sought an injunction to restrain an alleged breach by the defendant Council of the provisions of Secs. 19 and 20 of the Electric Lighting Act, 1882. The case was fully reported in our columns, and the judgment was published in our issue on May 22nd, 1914.

That which gave rise to the present proceedings was a circular issued by the Council in September, 1911, which stated that the Committee recommended "that the present scale of charges remain in force where power and lighting are both taken exclusively from the Council's electricity mains, but in cases where electricity supply is taken for power only, or for power and partial lighting, the lowest scale of charges where the number of units consumed during any quarter exceeds 4,000 shall be 1d. per unit, and otherwise according to the existing scale. Such amended charge to commence January 1st, 1912."

It was alleged that the differentiation expressed in this circular was a breach of Secs. 19 and 20 of the Electric Lighting Act, 1882. Mr. Justice Sargant held that there had been a breach of both sections, and that the plaintiff was entitled to a declaration accordingly, with liberty to apply for an injunction if necessary. Hence the present appeal of the Council.

Mr. Vesey Knox, K.C., Mr. Martelli, K.C., and Mr. Courthorpe Munroe appeared for the appellants; and Mr. Mark Romer, K.C., and Mr. Percy Wheeler for the respondents.

Mr. Vesey Knox said that the case raised a very important question as to the interpretation of Secs. 19 and 20 of the Electric Lighting Act, 1882, which dealt with equality and undue preference.

Putting it roughly, the short point was this:—The Council and the electricity undertaking had in force a tariff according to which larger factories were supplied at the price of ¾d. per unit for power, and, roughly, 3d. per unit for energy used for lighting those factories — that was reducible in certain circumstances. The Council decided that after a certain date factories not wholly lighted by electricity should pay 1d. instead of ¾d. for power. The action was brought by the Attorney-General on the relation of the gas company, and not on the relation of any consumer who had suffered from the undue preference. It had been decided by the learned Judge that this was contrary to the provisions of the Electric Lighting Acts.

In the course of his judgment, the learned Judge said this:—"It would seem that A must not be charged less than B, merely to overcome a greater reluctance on the part of A to become a customer, or to induce A to become a customer in respect of another supply, although either of these reasons might be a good commercial reason for charging less to A were the public undertakers merely carrying on any ordinary commercial business. On the other hand, any circumstances which render it less costly or otherwise more profitable to supply A than B constitute a legitimate reason for making a lower charge to A for the same supply. And if the Court once came to the conclusion that some such circumstance existed then proof would not be required that the diminution in the charge was precisely equivalent to the diminution in the cost of the supply."

Mr. Justice Sargant's judgment, said the learned Counsel, was regarded throughout the country by electrical undertakers with consternation, and if the law was as was laid down by his Lordship, the law must be altered, as otherwise electric supply could not be continued. A second consideration which he thought the learned Judge had overlooked was, that this business was an extremely competitive one, and was very difficult to get. The appellants had the gas company competing with them for the supply of light, and in a less degree for power. Then, in the case of power, there was a competition with steam, and in that particular district a large number of manufacturers gave up steam

and took electricity. Those were things which could not be overlooked in connection with the supply of electricity, and if they were overlooked the result would be bankruptcy.

Continuing, MR. VESEY KNOX said he did not shirk from justifying the circular as a whole, but the question was whether anyone had been unduly preferred.

The MASTER OF THE ROLLS: You must stand or fall by the circular.

MR. VESEY KNOX: I say in considering whether a preference is due or undue any commercial reason is a circumstance to be considered. The point of the judgment of Mr. Justice Sargant is that you are not to take competition into account at all.

LORD JUSTICE SWINFEN EADY: In your circular you say: We supply current to two persons under exactly the same conditions subject duly to this—that one of the two is a man who works a gas engine; we will charge him more. Is the fact that one customer has a gas engine a reason why you should charge him more than anyone else?

MR. VESEY KNOX did not contend that there might not be cases of hardship. But what the Council did in the hard cases was not to enforce their circular.

LORD JUSTICE SWINFEN EADY: Is that difference not illegal?

MR. VESEY KNOX submitted not. In making rules you had to regard all the customers that would be profitable to the undertaking having regard to the difficulty of getting contracts. He submitted that the appeal ought to be allowed.

MR. MARTELLI having followed on the same side, their LORDSHIPS, without calling on the other side, dismissed the appeal.

The MASTER OF THE ROLLS said: This is an appeal from the judgment of Mr. Justice Sargant, who has made a declaration that the defendants, in making the differentiation referred to in the circular of September 25th, 1911, were acting in breach of the Electric Lighting Act of 1882. Before going further I wish to deal with one point Mr. Martelli raised. He says the error the circular made we never have acted upon. That seems to me to be an absolutely irrelevant remark. If a man threatens and intends to do something, and asserts the right to do it, the Court will grant an injunction to restrain him. It is irrelevant to consider whether he has, or has not, done it. The Long Eaton Urban Council on September 25th, 1911, issued the circular complained of. By their defence they say it was quite right, and I cannot listen for a moment to the suggestion that though the circular was wrong the declaration was improper, because they, in fact, have chosen not to enforce it. They had no right to threaten, and intend to do that which the circular states, if the circular is wrong. As to whether the circular is right or wrong I have difficulty in treating the matter seriously. It seems so plainly wrong that I am not going to waste words on it. The Judge has decided that in making the differentiation the Council are acting in breach of Secs. 19 and 20. In my opinion it is impossible seriously to doubt that that declaration is perfectly correct. In my opinion it is right, and this appeal must be dismissed, with costs.

LORD JUSTICE KENNEDY: I am entirely of the same opinion.

LORD JUSTICE SWINFEN EADY: I agree.

SMOKE NUISANCE.

AT the Manchester City Police Court on October 28th, Messrs. Connolly Bros., cable manufacturers, of Blackley, were fined £5 and costs for neglecting to comply with an order made upon them to abate a nuisance caused by the emission of black smoke. A representative of the firm said they were at work every week-end trying to minimise the trouble, had experts on the work, and were getting new machinery and carrying out other improvements.

HERBERT MORRIS, LTD., *v.* SAXELBY.

IN the Chancery Division on Friday, October 30th, Mr. Justice Sargant delivered his reserved judgment in this action, which was brought by Herbert Morris, Ltd., of Loughborough, for an injunction to restrain an alleged breach of covenants in a service agreement made between the parties. The case was argued by Mr. Walter, K.C., and Mr. Kerly K.C., for the plaintiffs, and Mr. Mark Romer, K.C., and Mr. Sheldon for the defendant, and was reported in the ELECTRICAL REVIEW, October 23rd, page 553.

His LORDSHIP, in delivering judgment, said that by the action the plaintiffs sought to restrain the defendant, a former servant, from selling, manufacturing, or dealing in, either by himself, or in conjunction with, or as servant or agent of any other person, any pulley blocks, overhead runs, electric overhead runs, overhead tramways or overhead cranes, and from using or disclosing any confidential information he might have obtained while in the plaintiffs' employ. There was no evidence to show that the defendant had committed any breach of any obligation not to disclose confidential information, and, in fact, the plaintiffs at the trial offered none and abandoned that part of their case. The plaintiffs were very successful makers of the class of goods mentioned, and, in fact, such manufacture formed about three-quarters of their whole business. For it they had a special class of machinery, and the trade extended all over the United Kingdom. They had branches at London, Manchester, Birmingham, Sheffield, Newcastle, and Glasgow, and offices in other towns. They had a very thorough organisation of their business both from a manufacturing and commercial standpoint. They had arranged in a careful systematic manner a number of cards showing the strength and elasticity of metals and a mass of technical knowledge useful for this particular branch of their business, and also carefully tabulated information as to the requirements of their customers and of probable customers. All these cards were shown from time to time to their employés, but care was taken that they should be returned, and he did not think it was possible for any employé to carry the detailed information away in his head. The only knowledge that could be retained would be the general principle of this elaborate scheme. The defendant, who was now 29 years of age, when between 15 and 16 entered the plaintiffs' employment as draughtsman, and before he was 21 had obtained the position of leading draughtsman. He had been engaged in connection with overhead travellers, but up to that time had had nothing to do with electric overhead runways. His salary then was 50s. a week, and on attaining 21 he entered into an agreement dated July 16th, 1906, containing covenants similar to those sued except that it did not mention electric overhead runways. He went to manage a branch the plaintiffs then had at Cardiff, and remained there until February, 1909, when he went to the London branch and took part in the selling. In 1910 he left London to take charge of the selling department at Loughboro', where he remained until he left the plaintiffs' employ in April, 1913. On March 17th, 1911, he entered into the agreement sued upon. Under this his salary was to be £3 a week, and his engagement was for two years certain. The prohibitive clauses of that agreement upon which the present action was brought were as follows:—

Clause 6.—The employé shall not, during the continuance of the agreement, divulge to any person or persons any information received or obtained by him while in the company's employ, and any drawings, orders, &c., obtained by him shall be the exclusive property of the employer.

Clause 7.—He will not, during a period of seven years from his ceasing to be employed by the company within the United Kingdom, Great Britain and Ireland, either alone, or jointly with any other person or persons, be engaged in the sale or manufacture of pulley blocks, overhead runs, electric overhead runs, overhead travelling cranes, or any parts thereof.

In March, 1913, the defendant being unable to obtain such an advance in his salary as he considered adequate, went to France, and entered into the employment of a French firm, who were the plaintiffs' French agents. The defendant could honestly employ his trade to the best advantage within the terms of his agreement, and he could not find that he had gone further than to use for the French firm the qualifications he had acquired from the business training he had received from the plaintiffs. He, however, did not find his surroundings congenial, and left in 1914. In March of that year he took employment with Messrs. Vaughan, who did sell some of the articles mentioned in the agreement. This, of course, was a clear breach of the covenant, but the defence was that the covenants were unreasonable and in restraint of trade. From the point of view of the employer, he (the Judge) was not prepared to say that they were unreasonable. He thought that competition in any part of the United Kingdom might result to the disadvantage of the plaintiffs. On the other hand, he had to consider the matter from the point of view of the public. It was of importance to consider that this restraint was practically universal, and it was for a considerable period, a period of seven years. It was practically for all the defendant's life, because for seven years he would have to earn his living at some other business, and he could not hope after that lapse of time to return with any success to his original employment. He (the Judge) was satisfied that if the injunction was granted as asked, the public would be deprived of the amount of application to business, skill and experience the defendant had acquired in the course of his training at the plaintiffs' works. He would have to make a start in a fresh kind of business, but his efficiency and power of earning must be materially impaired. It was necessary for the Court, therefore, to consider the kind of knowledge that the defendant had acquired from the plaintiffs. He had not acquired any private connection with the customers of the plaintiffs, and no damage to the plaintiff company could be put on any ground of that kind. Any damage to them must be due to the severe competition in this kind of business. A most material point was that the defendant had been called upon to sign an agreement before he was 21, when his experience was merely that of a draughtsman, and when he had had no connection with the commercial side of the business. For the plaintiffs to deprive the defendant from earning his living by the work for which he had been specially trained for a period of seven years was pushing their policy of preventing competition to an unreasonable extent, and the covenants were therefore bad. The action must accordingly be dismissed with costs.

TORPOINT U.D.C. *v.* TORPOINT ELECTRIC SUPPLY CO., LTD.

THE arbitrator appointed to settle this dispute has given his award against the company on all points submitted to him, and ordered the company to pay the costs. The dispute was chiefly concerning two clauses in an agreement of April 2nd between the company and the Council for the supply of electric light, stipulating that the company should submit plans for the approval of the Council, and that if the light were not supplied by September 30th the agreement should be at an end, and the company should pay the Council £100 by way of damages.

MORELAND & SON, LTD., *v.* BOSCH MAGNETO CO., LTD.

IN the King's Bench Division on October 30th Mr. Justice Rowlatt concluded, after four days' hearing, an action brought by Richard Moreland & Son, Ltd., builders, of 80, Goswell Place, against the Bosch Magneto Co., Ltd., of 40 and 42, Newman Street, Oxford Street, in which the plaintiffs claimed £2,639 13s. 2d., for work done and materials supplied. The case raised questions between the building owner, the builder and special tradesmen.

Many witnesses were called on both sides, and in the result his LORDSHIP gave judgment for the defendants.

Baillie *v.* Oriental Telephone and Electric Co., Ltd.

In the Chancery Division on Tuesday, Mr. Justice Astbury heard a motion on behalf of J. R. Baillie, against the defendants for an injunction to restrain the company and four of the directors from paying to themselves an increased remuneration as directors of another company called the Telephone Co. of Egypt, Ltd.

Mr. Frank Russell, K.C., who appeared with Mr. H. E. Wright for the plaintiff company, said the motion was to restrain the defendants paying a certain remuneration in excess of a total sum of £800 a year, and from otherwise acting on two special resolutions passed at an extraordinary special meeting of the company held in July this year. The defendant company held a large block of shares in the Telephone Co. of Egypt, Ltd., and four of the five directors of the defendant company were sole directors of the other company. On June 15th, 1914, a notice was issued convening a meeting of this company. It was called to ratify certain votes given by the directors increasing their remuneration of the other company. The meeting was held on June 24th, and there were present only 15 to 20 shareholders. No statement was made at the meeting as to what the remuneration was which these people had been getting, and when the chairman was asked about that, all that he replied was, that they had sufficient proxies to carry the resolution. The resolution was then put to the meeting, and carried.

Sir Chas. McNaghten, K.C., for the defendants: That statement is contradicted.

Mr. Russell said a confirmatory meeting was held on July 15th, at which six shareholders were present. Again the amount involved was not disclosed. The plaintiff protested, but again the proxies came rolling up, and the resolution was carried. Counsel went on to state that the directors had actually drawn a sum of £44,876 out of this company, and, in addition, they had a little nest-egg of undrawn remuneration of £7,100. The plaintiff's case was that the notice convening the meeting was insufficient and misleading, and therefore the resolution was not duly carried.

Sir Chas. McNaghten took the point that an individual shareholder could not maintain an action without the defendant company being made co-plaintiff.

His Lordship sustained this point, adding that the plaintiff was not entitled to maintain the action without joining the company as plaintiff. The motion, therefore, failed.

Beck Engineering Co. *v.* The Foster Engineering Co.

On Tuesday, Mr. Justice Eve, sitting in the Chancery Division, heard an adjourned summons in this action. The proceedings, said Counsel, were taken at the instance of the plaintiff company to raise a question on the terms of an agreement for the supply of about 250,000 carbons for use in the Beck flame electric arc lamp, of which the plaintiff company held the letters patent. The carbons were at present in charge of a Receiver appointed by the Court. Plaintiffs and defendants were parties to an agreement that the defendant company should, as agent of a German manufacturer, supply the carbons at a stipulated price which was set out on the agreement. On the declaration of war the question arose between the parties as to the price at which the carbons should be sold by defendants to plaintiffs, and failing an agreement, the matter was taken before Mr. Justice Sankey, who appointed a Receiver of the goods. The plaintiffs now contended that they were entitled to be supplied with the carbons at the rate current during the last six years, while the defendants argued that they were only entitled to be called on to sell the carbons at the current price. Having regard to the fact that the war was in progress and practically all the carbons were manufactured in Germany, the price had gone up about 50 per cent.

After some discussion, the matter was allowed to stand over for an early date to be fixed for the trial of the action.

A question was also raised on a further summons whether an order made by the Master in Chambers should be reversed. The Master had directed the Receiver to sell to the Lancashire and Yorkshire Railway Co. 4,000 sets of carbons as part of an agreement between the parties. It had been arranged, said Counsel, that the railway company should be supplied with carbons at a price which was a considerable advance on that ruling before the war. After consultation it was arranged that half the quantity should be supplied to the railway company, the residue to remain with the Receiver until after the trial of the action.

McDonald *v.* Fyfe, Wilson & Co.

In the Court of Session, Edinburgh, the action has been settled in which plaintiff, of Leith, sued defendants, wholesale electrical agents, of Glasgow, for £105 12s. for alleged breach of contract. Pursuer is lessee of the Drill Hall Picture House, Loanhead, and he entered into a contract with the defenders for the hire of certain electrical plant in connection with the picture house. The machinery was to be delivered on August 22nd, 1913. On this date the pursuer paid the first instalment of hire, but the plant was not then delivered. A temporary set was delivered on August 29th, but the complete set was not delivered until September 10th. Lord Anderson, before whom the case came, had held that the defenders had broken their contract, and he allowed a proof as to the amount of damages due to pursuer. On Friday his Lordship was informed of the settlement, a joint minute being put in. It is understood that the defenders have made a payment of £40 and expenses to the pursuer in settlement of his claim.

WAR ITEMS.

Board of Trade Reports.—In connection with the Board of Trade campaign and the large number of inquiries received for names of sellers or buyers of articles, of which the sources of supply or markets have been interfered with by the war, the Commercial Intelligence Branch has prepared lists of articles which inquirers desire (*a*) to purchase and (*b*) to sell. The third list, in which is incorporated the first and second lists, was published on October 14th; the fourth list, which is a supplement to the third list, is now ready, and may be obtained, together with copies of the third list, on application to the Branch.

No. 86 of the special series of campaign pamphlets issued by the Board of Trade deals with Germany's textile machinery exports. Report No. 87 relates to sanitary ware.

Government Assistance.—The Chairman of the Birmingham Chamber of Commerce said last week that trade was much better than might have been expected. Government work was assisting very much, but there was a great deal being done outside that. Many articles previously made in Germany and Austria were now being made in Birmingham. The question of the best way of ensuring continuity of that trade had been under consideration, and the Government might be asked to step in and assist in some form. In due course some recommendation would be made to Government.—*Times.*

The Birmingham Chamber of Commerce has approved a proposal to the Government in favour of advances being made to British traders on the security of approved foreign debts, pending the restoration of normal conditions in the foreign exchanges, so far as neutral countries and the Allies are concerned, and the termination of the war so far as Germany and Austria are concerned. Such arrangement is stated to be urgently needed to facilitate the operations of merchants and manufacturers in meeting the demands they are now getting from colonial and neutral countries owing to practical cessation of the German and Austrian export trade.—*Financial Times.*

The Treasury announces that a committee, consisting of representatives of the Treasury, the Bank of England, the joint stock banks, and the Association of Chambers of Commerce of the United Kingdom, has been formed, to whom is delegated the authorisation of advances in approved cases to British traders carrying on an export business in respect of debts outstanding in foreign countries and the Colonies, including unpaid foreign and Colonial acceptances, which cannot be collected for the time being.—*Times*

Oldham Council and its Contracts.—Another discussion on trading with firms having German capital took place at a meeting of the Oldham Town Council on October 28th. Councillor Dixon said he believed inquiries which had been made regarding the Tudor Accumulator Co., Ltd., had shown that out of £50,000 capital, £47,000 was German. If he was correct in that, he hoped that the Corporation would not go on with their contract with that firm. He was one of those who believed that every penny paid to the Germans now was an extra bullet to shoot our soldiers. Councillor Hardman (chairman of the Electricity Committee) said that it was true that £47,800 of the £50,000 capital in the firm mentioned was held in Germany. Steps were being taken by his Committee regarding the matter, and he was in communication with the Board of Trade with regard to the accounts which ought to be paid to the firm. Alderman Greaves asked whether the Corporation had a right to withhold payment of the accounts, and said he had understood the Town Clerk to say they had. The Town Clerk said he had not advised that payment could be refused. These firms were not alien enemies. A writ had been issued against the Corporation in a case which was referred to at the last meeting. Councillor Frith and Councillor Stanbury expressed the hope that contracts would not be entered into with firms that had a German appearance. Answering Councillor Low, Alderman Isherwood said he was willing to take back the account referred to. Further discussion took place upon the Town Clerk's statement, and the Town Clerk said there might be good reason for the Corporation not entering into any new contracts with a firm of this sort, but as a matter of law the Corporation had had the goods and they would have to pay for them. The money, he added, was not going to Germany. Alderman Isherwood, in closing the discussion, said he proposed to hold the account back until there had been some definite ruling given. With regard to another account held back at the last meeting, the Corporation had received a writ for the money, and until the point was decided he did not propose to pay any of the accounts.

Birmingham Electricity Department Employees.—According to a Birmingham paper, 147 of the staff and workmen of the Birmingham electricity supply department, out of a total of 645, were on active service. Allowances were being made to them in accordance with a resolution of the City Council. The total amount paid at the present time was at the rate of £4,500 per annum. A certain number of temporary men had been taken on to replace those who had gone, and, with a few transfers of labour from one section to another, the work of the department was being carried on satisfactorily.

London Electric Firm.—This Croydon firm asks us to state that it is entirely British in its proprietorship, capital, staff, workmen, and the whole of the materials entering into its manufactures. A number of the staff and workpeople have joined the Services, whilst all remaining eligible ones are being urged to do so, with the assurance that their posts will be kept open for them, and half pay made during the period of the war.

Contraband of War.—In a new Proclamation dated October 29th the following articles are included :—

Schedule 1.—*Absolute Contraband*—

Sulphuric acid.
Range-finders and their distinctive component parts.
Hæmatite iron ore and hæmatite pig-iron.
Iron pyrites.
Nickel ore and nickel.
Ferrochrome and chrome ore.
Copper, unwrought.
Lead, pig, sheet, or pipe.
Aluminium.
Ferro-silica.
Barbed wire, and implements for fixing and cutting the same.
Motor vehicles of all kinds and their component parts.
Motor tires : rubber.
Mineral oils and motor spirit, except lubricating oils.

Schedule 2.—*Conditional Contraband*—

Railway materials, both fixed and rolling stock, and materials for telegraphs, wireless telegraphs, and telephones.
Fuel, other than mineral oils. Lubricants.
Field glasses, telescopes, chronometers, and all kinds of nautical instruments.

The Amsterdam correspondent of the *Times* says that the latest lists of conditional contraband issued by the Netherlands Government contain the following :—On the French side—Iron, steel, oxide of iron, sulphate of iron, carbonate of iron, copper, lead, nickel, ferrochrome, glycerine, hides, leather, inside and outside motor tires and material of which the tires are made. On the German side—Crude copper, block lead, lead plates, and lead tubes.

The *Times* correspondent at Ottawa says that the Canadian Government has passed an order prohibiting the export of nickel ore to Europe, except to Great Britain. The export to the United States is permitted, but under regulations forbidding its use for manufactures for Germany or Austria.

National Defence.—At a meeting of the Naval and Military Defence Standing Committee of the London Chamber of Commerce resolutions were adopted urging upon the business community the importance of continuing until the end of the war to assist by every means in their power the enrolment for the war of further recruits for Lord Kitchener's army, in view of the vital attack against the security and existence of the Empire, and having regard to the need for strengthening home defences, strongly supporting the movement initiated in connection with the Central Association of Volunteer Training Corps for enabling the civil population to gain instruction in drilling and the use of arms.

The Trade War.—A report has been adopted by the Manufacturers' Section of the London Chamber of Commerce relating to competition with German and Austro-Hungarian trade. A considerable amount of information has been collected on this subject relating to a very large number of industries and a number of constructive and critical suggestions have been received from manufacturers and from merchants. In cases where manufacturers have intimated that they are open to manufacture new articles hitherto largely imported from Germany and Austria they have been put into touch with merchants and inquirers for such commodities through the Statistical and Information Department of the Chamber. One of the appendices to the report, which has been sent to the Local Government Board, shows that as a result of the dislocation of business caused by the European war and the abnormal conditions of trade, there has been a general and substantial decrease in the manufacturing industries and only a very small increase in certain special trades, but, on the other hand, the number of cases in which business is practically suspended is infinitesimal. Naturally, unemployment has resulted to some extent, and the number of employés joining the Colours has not quite counterbalanced the decrease in employment. In a large percentage of cases supplies of raw material which has previously come from abroad could be obtained in this country or from new sources, and so far as can be ascertained no very great difficulty has been experienced in connection with transport by rail, road or sea. Industry has been very largely affected by the financial conditions and the reduction in orders both from abroad and from home, but it is not generally considered that orders at home have diminished as a result of the failure of credit but rather from other causes. Various suggestions have been made to assist trade, and special attention is called to the desirability of the bankers being induced to give greater financial facilities to employers of labour and others in connection with the development of existing manufactures and the establishment of new industries in order that the country may be in a position to take full advantage of the change in the economic conditions brought about by the war. The Emergency Committee of the Manufacturers' Section has been re-appointed to give effect to the suggestions relating to allotment of army contracts, code facilities for cable communications, the relaxation of excise duties on alcohol, Government assistance for firms having large uncollected assets due from belligerent and neutral countries, the re-establishment of foreign exchange operations on a satisfactory basis and the relaxation of the Factory Acts to allow for more elasticity in the hours and conditions of working arrangements.

B.T.H. Recruiting.—The British Thomson-Houston Co., Ltd., of Rugby, has received the following telegram from its agents in Melbourne, the message having been dispatched upon reading a recent notice in our pages regarding recruiting at the B.T.H. works :—"Congratulations your sending over 900 fighters to front. We are proud of them. God speed and victory!" We understand that the number of B.T.H. recruits is now considerably over 1,000.

Liverpool City Council and its Contracts.—At a meeting of the Liverpool City Council, Mr. Gates moved the following motion of which he had given notice :—"That the Tramways and Electric Power and Lighting Committee cease all dealings with Thermit, Ltd., regardless of consideration for any legal question which such action may involve." He argued that they should view this question from the point of view of expediency, rather than from a business standpoint. The Tramways Committee had been too much obsessed with the sense of their legal responsibility. He was asking the Council to relieve them of that responsibility, and to say that this trading with the Germans should cease. Alderman Smith said he would readily vote for the motion if Mr. Gates would take the risk. He emphasised that they were not trading with Germans, but with a company which, by the law of England, was registered as an English company and endowed with an English patent. He, for one, was not going to act foolishly by giving any company largely owned by Germans a right to damages which the Corporation could not resist. Mr. J. L. Rankin moved the following amendment, which, he thought, would carry out what Mr. Gates desired :—"That the balance of the order with Thermit, Ltd., be immediately cancelled, and also that the contract with Tudor Accumulator Co. be terminated forthwith." The Town Clerk, replying to a question, said that whilst the contract with the Tudor Co. was finished, they were under an obligation to the Corporation to maintain the work in connection with the joints for a period of 12 months. Alderman Smith said that surely the Corporation was never going to place itself in the position of relieving this firm of their responsibility for maintaining the work to the extent of £700. That would be so according to the terms of the amendment. Mr. Rankin's amendment was carried by 47 votes to 6, and on the amendment being put as a substantive motion it was agreed to.

British Firms and German Agents in China.—The *Times* correspondent at Pekin states that the practice of some important British firms of confiding their representation in China to German firms is now bearing bitter fruit. The Chinese Government is declining to recognise newly-appointed British agents as qualified to receive or deal with payments in respect of contracts entered into through German houses. The correspondent says that : "The British Government would render a service by officially notifying the Chinese Government that German agencies of British firms have ceased, and that therefore no communications on behalf of British firms should be addressed to German agents."

Mr. W. Brayton Slater writes to us as follows :—"Manufacturers in this country should overhaul their agencies abroad, especially in the Far East, to make sure they are not being represented by Germans. Several manufacturers—including a big British armaments house—have for long been represented by Germans in China, and to-day they are decidedly, and most people will say deservedly, at a disadvantage. The Official British representatives are enforcing the prohibition against trading with the enemy in all British Colonies and settlements, and in Hong Kong and the treaty ports of China this is seriously interfering with the business of German firms. Some of them have taken temporary shelter under British names, but that device will not serve for long.

"There are numbers of reliable British or Chinese firms ready to handle any goods suitable for the market, provided their activities are adequately supported by the British manufacturer in a market that requires careful study, but which will be second to none in the world if developed with energy and intelligence."

Marylebone Men.—The Marylebone electricity supply department is represented in the National Services by the following—53 all told :—

Generating Station.—Messrs. — Batten, A. Baynton, J. Butler, F. Gates, B. Hartopp, J. W. Wood, A. P. Grover.

Mains Department.—Messrs. — Angell, E. G. Baker, A. Baxter, F. Boyall, — Curtis, J. M. Day, W. Higgins, H. Huggins, W. Leary, F. H. Noyes, A. L. Oliver, — Percy, E. V. Scammell, — Springall, A. W. Turner, — Ward, H. C. Winterford, J. P. Cleary, W. F. Gregory, A. G. Marshall, N. Bainfather.

Sales and Publicity Department.—Messrs. A. Alcock, H. Bulley, S. J. Chidwick, R. A. Cooney, W. H. Cummins, E. C. Rix, W. Rolfe, C. J. Rummey, A. J. Snow, E. Bennion, F. S. Bailey, G. H. Taylor, J. Ford.

Head Office.—Messrs. C. G. Adams, J. Atwill, C. H. Beechey, A. H. Bowen, S. E. Butcher, L. M. Howlett, S. King, W. Murray, A. R. Rayner, A. J. Scott, G. Sell, S. P. Youngs.

Trade with Russia.—H.M. Consul-General at Moscow reports that a firm in Ekaterinoslav desires to get into touch with manufacturers in the United Kingdom, or preferably their local agents, who can supply the following articles :—Electric motors and parts, lathes, drilling machines, wood-working machinery and benches, steam engines, materials for electrical installations, iron and steel implements and tools, belting, furnace bricks, tool steel compressors, Manila hemp ropes and steel ropes. Firms can obtain the name and address of the inquirer on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C., but they should address any further communications regarding the inquiry to the British Consulate-General, Moscow, furnishing the names of their local agents (if any).—*Board of Trade Journal.*

Mr. R. A. Lenski, of 114, Fenchurch Street, London, E.C., writes to say that one of the reasons why Russia imports so little from Great Britain is the difficulty experienced by Russian firms in learning the names of British manufacturers. He is preparing a directory of British manufacturers in the Russian language and wants to hear from firms who desire to export their goods to Russia

Northampton Tramway Manager.—The controversy at Northampton over the retention of the tramway manager, Mr. J. Gottschalk, who is of German birth, was not quelled by his suspension and the voting of £300 as a solatium. Five of the candidates, representing the anti-Gottschalk faction, withdrew from the municipal contests at the last moment, as we stated last week, but Mr. W. Smith, who was selected for the Castle Ward, refused to do so. He stated in his election address that his sole object in forcing a contest was to give the electors "the opportunity of expressing their opinion on the Gottschalk question through the medium of the ballot box." Mr. Smith was returned by over 200 votes on Monday in preference to Mr. A. G. Whitlock, the old member, who voted for Mr. Gottschalk's retention.

Burnley Tramwaymen.—Some 103 employés of Burnley Corporation tramways have rejoined the Colours or enlisted since war broke out. This, it is stated, gives the biggest percentage of any tramway system in England. To each man, the manager, Mr. Hy. Mozley, has sent a letter and, in many cases, the soldiers have replied to them. In addition to allowances made to the men by the Corporation, the fellow workmen and friends have subscribed and provided each man with a pipe and tobacco.

German Contract re-let in England.—A contract for three pairs of new dock gates required by the North-Eastern Railway Co., in connection with new entrances at the Hartlepool docks, which was orginally placed with the Gutehoffnungshutte Coal, Iron, Steel and Engineering Co., of Oberhausen, Rhineland, has been rescinded, and the work has been re-let to Sir W. G. Armstrong, Whitworth & Co., Ltd., whilst the sluice and gate machinery will be supplied by the Hydraulic Engineering Co., Ltd.

Personal.—The Bispham U.D.C. has undertaken to make up the difference between the army pay and the full salary of Mr. George Ollier, assistant electrical engineer, who is now serving with the Royal Engineers.

Private T. E. King, of 3, Greenwood Street, Burnley, a local tramcar conductor, has been wounded in the foot and is in hospital at Chatham.

Private B. C. Parker, an Accrington tram conductor, has been shot in the breast but is recovering.

Private Chas. Lawson, of Castle Street, Stalybridge, a conductor on the Joint Board tramways, has been taken prisoner by the Germans whilst serving with the R.A.M.C. at the front.

Roll of Honour.—Private Peter Liptrot, a Wigan Corporation tramguard, has been reported killed in action.

REVIEWS.

Electric Traction. By Lionel Calisch, A.M.I.C.E., &c. London: The Locomotive Publishing Co., Ltd. Price 2s. net.

Mr. Calisch has produced a little book on a large subject which should prove useful and instructive to railwaymen in general. It was written originally in the form of articles in the "Great Eastern Railway Magazine," and could have been improved in style and arrangement as a volume by editing with a greater regard to the requirements of a book intended for consecutive reading and permanent reference, as contrasted with a succession of articles contributed to a magazine. If such discrimination had been exercised, probably Chapter VII, "The Economic Aspect of Electrification and its Advantages over Steam," would have been inserted as Chapter II after Chapter I, "Historical Notes: Classification of Railway Traffic." There is a curious innovation in the make-up of the book. Each chapter is headed, at the top of the page, "Chapter I," etc., without further title or description. The titles of the chapters, and a list of the subjects discussed or described, are given in the "Contents" only, and there is no index.

This unceremonious way of starting chapters produces an impression of want of finish, as though the book were made up of "galley sheets," snipped to length. Perhaps this is only an expression of conservatism as to appearance. It seems convenient, though, that a reader should see the subject title at least at the head of each chapter, if only to prepare his mind; and certainly if he wants to refer to something he remembers to have read, the want of an index makes the book less handy.

If the book were not good and useful it would not be worth while to criticise these matters of form and arrangement, which detract sensibly from the attractiveness of the work.

The author has compressed into the book a large amount of information well selected to give a general knowledge of how electric traction is applied to railways, what it has done, and what it may be expected to do in the near future for railway working. It would be easy to point out where he has gone too far into technical matters, and yet not far enough, but a reviewer who has had similar tasks sympathises with the difficulty of drawing the line in descriptions and statements of a technical character. The statements of the traffic and economic advantages of electric traction are well put, and supported by a great number of quotations from railway authorities at home and abroad.

At several places the author seems to be a little uncertain what he wants to say, and leaves a confused impression as to his own views on the subject. This may be due to a desire to present both sides of a controversy, but it is not quite the same thing. A particularly striking example is his presentment of the question of the effect of height of centre of gravity upon the riding qualities of a locomotive, and the side-wear of rails, commencing at the bottom of p. 56 with the words: "Mr. Aspinall was one of the first to draw attention to the fact that, in his opinion, the serious side-wear of rails . . . . on the curves of electrified railways is due to the low centre of gravity of motor trucks." This is a sentence the author will wish to re-write. Mr. Aspinall's opinions are worthy of the greatest consideration, but he will hardly draw attention to them as facts. As the author a few lines further down says that it is not at all certain that these theories (as to the relation of side-wear and low centre of gravity) are correct, gives some evidence tending to show that they are not, reverts to other evidence supporting them, and ends up with the statement: "Experience has shown that electric locomotives with a low centre of gravity will not increase the track maintenance provided that" certain other matters are properly co-related in the design, the general reader may wonder at the end why the last quoted sentence, or a more general statement that the matter is unsettled, and is a question of design involving other points, would not have sufficed.

There is room for criticisms of style, mostly in respect to redundancy and loose choice of words suggesting hasty writing and inefficient revision, which the author will be well advised to rectify when a second edition is called for, as may happen within a reasonable time. No doubt some more material items will then call for revision and addition too.

Chapter VII sets out the advantages of electric traction on surburban lines, showing that the net result is an increase of profit, and how the result is made up, with numerous examples from electrified lines of that class. It is, perhaps, the best chapter in the book, marred by some of the defects of style and order already referred to, and ending with a pair of apparently contradictory statements calculated to perplex.

Chapters VIII and IX deal with main-line electrification in a fair and temperate way, putting the case for goods traffic and for electrification as an alternative to widening lines and increasing terminal accommodation in a way which must come home to railway men who know what a steam line working up to its utmost capacity means, and will sooner or later command the assent of the highest authorities and even the capitalists who will have to find the money.

The following sentences on p. 105 seem open to question, or at least to explanation: "The electric locomotive has a longer life than the steam locomotive, but owing to its first cost being greater the actual depreciation charge per locomotive is greater. As, however, the number required to handle a given traffic is much smaller than the number of steam

engines in use, the total depreciation is generally higher for steam operation." One dimly feels what the author means. In fact, however, the depreciation of a steam locomotive is a purely fancy figure on British railways, and its life may be anything from that of its first firebox to that of its number plate, as successive locomotive superintendents may determine. Electric locomotives and motor-cars will doubtless be treated in the same way, and the proper comparative figures will be those of repair, maintenance and building new units sufficient to keep the service running.

We can recommend the book to railway men and others interested in the subject; and to the author, to take in hand and turn into a much better one.

Questions and Answers about Electrical Apparatus. By J. W. Craig and W. P. Woodward. London: S. Rentell & Co. Price 6s. 6d. net.

This small book is the third edition of an American publication which is supposed "to bring out many interesting features of the more important types and classes of electrical apparatus and the general points of a useful and practical nature which come up in the testing and operation thereof." Undoubtedly some useful information is given, but it is difficult to understand for what class of reader the book is intended. For example, the first question is: "What are the principal uses of direct current?"; one about the middle is: "Why are transformers used?"; and the last question is: "What storage arrangements for coal are advisable?" There are many more of the same character.

Scattered through the book are 44 advertisements, and there is a small collection of them at the end. The only index provided is one for the above-mentioned advertisements.

The reviewer considers the price to be expensive beyond all reason.

The Mechanical Design and Construction of Generators. By R. Livingstone. London: *Electrician* Printing and Publishing Co., Ltd. Price 9s. net.

The mechanical design of electrical machinery has hitherto received far less detailed consideration than the electrical side of the problem—at least, as regards text-books. While several books dealing with the principles of electrical design do not altogether ignore the question, it is usually dismissed with a very brief and practically useless chapter. The book under review has been specially written to fill this gap.

The opening chapter deals with pulleys, gearing and couplings. While the part dealing with pulleys and gearing is what might be more or less obtained in a pocket book, the design of couplings is entered into at considerable length. The author's style is not such as can easily be followed. A mistake occurs on p. 29, where $4\,t\int_0^{\frac{\pi}{2}}\left(\frac{A}{2}\cos\theta\right)^2 A\,d\theta$ is put $=\frac{A^3\,t\,\pi}{8}$ instead of $\frac{A^3\,t\,\pi}{4}$, which vitiates the results which follow.

Chapter II discusses rotor hubs and end plates. In the opinion of the reviewer, all formulæ for hubs that are based on the thin cylinder assumption are worse than useless—they are actually misleading, and he agrees with the author that the only satisfactory way to estimate the forcing pressure required, or the clearance, is to rely upon practical experience. At the same time, a method of dealing with this problem by the method of thick cylinders was developed several years ago, and this is much more rational than the one given. The strength of armature end plates is then dealt with in a manner which is not conspicuously clear to say the least. A mistake appears on page 43, in which $\int_0^{\frac{B}{2}}\frac{16\,\pi\,x\,\delta\,E\,t}{B\,D}\,dx$ is put $=\frac{2\,\delta\,\pi\,E\,t\,B^2}{D}$ instead of $\frac{2\,\delta\,\pi\,E\,t\,B.}{D}$ This error again makes the deduced formulæ faulty. On page 51 the allowable tensile stress in cast iron is given as 8,000 lb. per square inch, which seems too high, considering the treacherous nature of the material.

Unbalanced magnetic pull receives attention in Chapter III, in which a number of well-known formulæ are given.

Chapter IV is devoted to shafts and bearings. The method of calculating the reactions and bending moments in a single beam, as given in every elementary text-book on applied mechanics, is dealt with at length. Surely this is unnecessary in a book of this description. Deflections are calculated by means of the curves developed by the author. Ordinary bearings are treated in detail, but ball-bearings do not receive anything like the attention they deserve in view of their increasing use, and roller-bearings are ignored altogether.

Chapter V discusses the important subject of shaft alignment, and a large collection of formulæ are given.

The strength and stiffness of alternator and direct current stator frames are then considered as thin metal arches fixed at the ends. The long and complex analysis of this type of arch as given in books on the theory of structures is reproduced and applied to the design of stator frames. A formula for the deflection at the top of the arch is given, and it involves a numerical co-efficient of .0062. The author states that in getting this a log table must be used, since the ordinary slide-rule is not accurate enough. The reviewer thinks this statement rather ridiculous since he obtained .0061 without any special care on an ordinary 10in. rule, and, moreover, the value of this constant is of less importance than the other terms in the expression, *e.g.*, it would be practically impossible to get the moment of inertia of the cross section of the frame (and this is required) with this degree of accuracy.

Chapter VII deals with the stresses in rotors. A formula for the force in the binding wires of armatures is given on page 144, but the reviewer is unable to get the constant given in the denominator of the author's expression. The value of the acceleration due to gravity is given on page 149 as 32·19078, and used in calculating a centrifugal force formula. This kind of thing is misleading, since the other quantities required cannot be obtained to anything remotely approaching this degree of accuracy.

Poles and end clamps are next discussed. The salient pole type of machine only is considered, and a large number of formulæ are given, some empirical, and some derived from considerations of elementary mechanics.

The next two chapters—consisting of 13 pages total—deal with field coil supports and with rotor bodies. Several tables are given which should prove useful.

Chapter XI deals with cylindrical rotors in a fairly satisfactory manner. Certain very important formulæ are quoted without any attempt to establish them from first principles.

High-speed bearings and critical speeds are dismissed in half a dozen pages, and the reader is referred to Dunkerley's Royal Society Paper for further information regarding whirling speeds. Much more space could have been devoted to the latter with advantage.

The remainder of the book consists of 18 pages devoted to general details, types of high-speed motors, and an appendix, the most noteworthy feature being several illustrations of turbo-alternators by well-known makers.

There are obvious misprints on pages 36, 49, 87, 134, 188, and 194.

The general impression of the book upon the reviewer is that it contains a good deal of information, but at the same time he would strongly recommend any buyer to check the mathematical expressions before he uses them. The price also seems excessive.

ELECTROSTATIC ORE SEPARATION.

The well-known phenomena of electrostatic attraction now receive practical application in a number of ore-separating equipments, most of which are installed in the States. So satisfactory are the results obtained, that the electrostatic process is certain to be adopted extensively in an ever-widening field. That separation of minerals is possible by electrostatic means depends on the great difference between the electrical conductivities of various minerals. Metallic sulphides are generally good conductors, while gangue-forming minerals are usually poor conductors. Pyrites, galena, argentite, tellurides, magnetite, hematite, hornblende, graphite, and most minerals of copper, iron, silver and manganese, among others, are good conductors, but quartz, sandstone, granite, feldspar, slate, fluorspar, limestone, dolomite and most siliceous materials, carbonates and sulphates are poor conductors.

If a mixture of (electrically) uncharged minerals containing good and poor conductors be allowed to fall upon a conducting surface charged to a high potential, the good conductors will at once become charged with like polarity and repelled, but the poor conductors will either fall off the surface by their own weight or be but weakly repelled, since they become charged but slowly. If the mixture be charged oppositely to the separator plate, the high conductivity particles will reverse their polarity on touching the conductor plate, but the materials of poor conductivity will be strongly attracted till their initial charge is lost (after a considerable time). Impurities frequently vary the conductivity of minerals very considerably, and this point must be borne in mind, since clean separation can only be made electrostatically between minerals having marked difference in conducting power. Some minerals may be changed from poor to good conductors by electrochemical action. According to the *Engineering and Mining Journal*, this fact is applied in practice at Ouray (Colorado) where zinc sulphide is immersed in copper sulphate solution till a light deposit of copper forms on the ore, which then behaves as a good conductor, since the electrostatic charge and action is a surface effect. Carbonates of poor conductivity can be changed to oxides of good conductivity by heating.

The principle of the Huff separator, which is used almost exclusively in electrostatic ore separation, is illustrated in fig. 1. The framework and casing of the separator are made of iron, which is carefully bonded and earthed to prevent accidents and to secure as high a P.D. as possible between the fixed baffle plates and neutral electrodes (fig. 1) and the high-tension bars, which are charged to 20,000 volts or so. Between the high-tension and neutral electrode bars, there is established an intense electrostatic field, and as mixed minerals pass through the separator by gravity from an overhead roller feed hopper, conducting materials are repelled forcibly to the left while poor conductors fall straight through, before any appreciable repulsion takes place. From some mixtures three or more "splits" can be made, but generally it is possible to make a clean separation only between two products at a time.

To distribute the work of separation down the separator column and to allow for the different composition and nature of various ores, the electrodes are made adjustable. Those at the top are set rather far apart, those at the bottom—where an intense field is required to expel the last traces of conducting material—are set quite close together. This arrangement also reduces the risk of sparking and short-circuit at points where the ore is still rich in conducting materials; at these points the electrodes are comparatively far apart.

In early designs of electrostatic separators, wood-encased steel wires were used as electrodes. Abrasion of the wood was heavy, and the protecting coat of shellac varnish became gummy, under heat produced by friction, electrostatic stress and the warm minerals themselves. As a result, the electrode rods became foul and sparking troubles and imperfect separation followed. Steel pipe electrodes, suspended and insulated by wooden plugs, are now generally employed. Constant attention is required to keep the electrodes free from grease and dirt, since a single grounded electrode places the whole separator out of action.

In order to secure satisfactory separation, it is imperative that the mixed ores be dry and warm before admission to the separator. The ore is necessarily ground fairly small before separation, and, apart from moisture making all ingredients sufficiently conducting to upset the separating action, endless trouble is caused by clogging and short-circuiting if the ore be moist. The mixed crushed ore should be dried at 300° to 600° F., depending on atmospheric conditions and the nature of the minerals treated. From the drier, ore should be passed as quickly as possible to the separators. The feed being warm eliminates condensation troubles and, by keeping dry the air within the separator, reduces the risk of sparking troubles.

A considerable percentage of minerals separated electrostatically is finer than 200 mesh, and when falling between the electrodes the finer particles have an excellent opportunity to float away. At best, the machine room of an electrostatic mill is a very dusty place, and operators

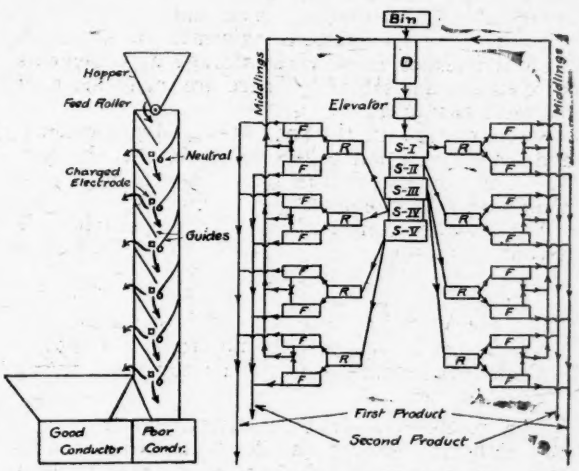


Fig. 1.

Fig. 2.

generally wear respirators. To reduce the nuisance and eliminate the wastage of mineral otherwise entailed, a ventilator is placed over each machine and connected to a central suction fan, where dust is collected in filter bags, 30 ft. or so in length and 12 in. in diameter. A dust chamber is also arranged below the fan which maintains draught in the drier.

Immediately after leaving the drier D, fig. 2, ore is elevated on to a series of screens S, which should sift the material into four or six sizes before passing it to the appropriate separator. Finely crystalline ore needs more initial crushing than an ore of coarse structure. Suitable sizings for different grades of material are as follows :—

Coarsely crystalline.	Medium texture.	Finely granular.
Through 4, on 8 mesh	Through 20, on 40 mesh	Through 40, on 60 mesh
,, 8, on 20 ,,	,, 40, on 60 ,,	,, 60, on 80 ,,
,, 20, on 50 ,,	,, 60, on 80 ,,	,, 80, on 100 ,,
,, 50, on 100 ,,	,, 80, on 100 ,,	,, 100, on 150 ,,
Through 100 mesh	Through 100 mesh	Through 150 mesh

Unless sizing be fairly accurate, a large particle of good conductor may carry with it mechanically several small poorly conducting particles, and a large piece of non-conducting ore may obstruct the flight of small repelled pieces. Generally it is necessary to treat the products of each roughing separator R in finishing machines F, forming two or more finished products and a quantity of middlings, which are either returned to the main drier to pass through the whole plant again, or preferably reheated and passed through small middlings separators. For an ore containing the following sizes of pieces in the stated proportions, the

desirable roughing and finishing equipment would be as shown in fig. 2 :—

Size of pieces.	Percentage of feed.	Separators. Roughing.	Finishing.
1.—Through 20, on 40 mesh	10 per cent.	1	2
2.— ,, 40, on 60 ,,	15 ,,	1	2
3.— ,, 60, on 80 ,,	20 ,,	2	4
4.— ,, 80, on 100 ,,	25 ,,	2	4
5.— ,, 100	30 ,,	2	4

The electrical equipment necessary comprises a motor-driven high-tension generator set, with regulating resistance in the motor field, and a rectifier, which is so connected that the live electrodes receive only a positive charge. The cost of this installation is very small.

The above process was introduced for use on zinc ores, and the separation of blende from pyrites is still its most frequent application, but among the materials which can be satisfactorily subjected to electrostatic separation may be noted :—Zinc, lead and iron middlings, chalcopyrite in quartz, pyrite and chalcopyrite in various gangues, chalcopyrite and bornite in granite, zinc, iron and silver ores, native copper in sandstone, pyrite concentration for sulphur, silver ores from a quartz gangue, molybdenite from gangue minerals, mica from graphite flake, slate from coal, and so on. The only limitation is that the materials treated must be sufficiently different in electrical conductivity.

POWDERED FUEL.

At the Spring Meeting of the American Society of Mechanical Engineers held at St. Paul, Minneapolis, the use of pulverised coal for fuel purposes formed the subject of three papers, which dealt respectively with its application to the cement industry, to steam making and to industrial furnaces. These papers are of considerable interest to the central station engineer, for although the use of powdered fuel for ordinary steam raising purposes may not be a commercial proposition at the moment, the future undoubtedly holds great prospects of developments especially at the "fuel" end of electrical generation.

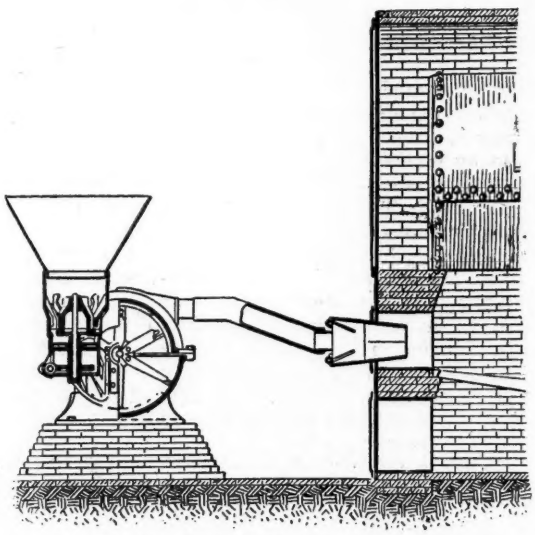
The ideal boiler plant, so far as simplicity of apparatus and operation are concerned, is generally considered to be one using oil fuel, which has the merit of being easily stored outside the station, conveyed to the furnace and automatically adjusted as to quantity supplied to the special burners employed.

Such a plant is in great contrast with that employed in the modern coal burning boiler house, in which costly elevated bunker structures are provided, and every ton of fuel usually has to be lifted to a considerable height by mechanical appliances in order to allow of its falling by gravity into another mechanical appliance —a hand regulated mechanical furnace—under the boiler; the ashes, moreover, require special appliances for their removal, and usually a specially constructed basement for the appliances. The coal is frequently crushed to a uniform size before it enters the bunkers, and while this rough attempt at grading, no doubt, helps towards efficient combustion on the grates, yet a percentage (frequently 3 or 4 per cent.) falls through as riddlings, and cannot be efficiently burned with the other fuel. However perfect the individual fuel equipment of the modern boiler house may be, as a whole it seems crude and complicated for its purpose, and although perhaps the best available at the moment, it cannot be regarded as final.

At first sight the use of pulverised coal would seem to offer a means of simplifying present day methods, in fact, of attaining more nearly the oil fuel ideal, but although sufficient progress has been made in this direction to give promise of future success, at present the use of powdered fuel under boilers is restricted to special cases.

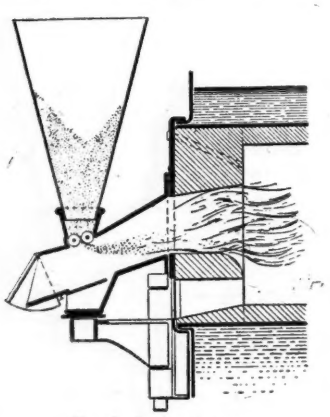
In the paper by R. C. Carpenter on pulverised coal burning in the cement industry, the author mentions that for more than 30 years various schemes for burning powdered coal under boilers have been suggested, and numerous patents have been taken out without any marked success, but in the Portland cement industry commercial success was obtained more than 15 years ago, although the type of furnace employed—the rotary kiln—had much to do with the practical success attained.

The burning of powdered coal differs from the burning of solid fuel from a theoretical standpoint, principally in one particular.

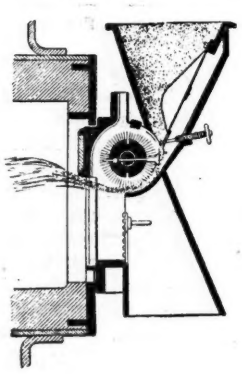


Day or Ideal Apparatus and Burner.

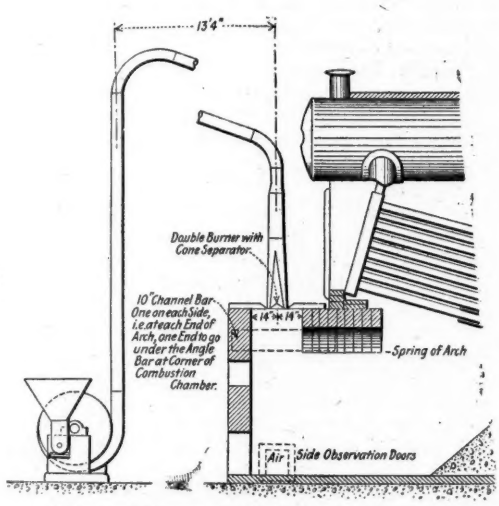
With ordinary commercial fuel on the grate, the air for combustion passes between the pieces of coal and the products of combustion pass off to the flues. In the case of coal dust, the particles are so fine that sufficient air for combustion does not reach the coal through the crevices. To burn such fuel successfully it must be burned while in suspension in the air, each particle being surrounded by air, which supports combustion. The furnace used in cement making is favourable to such combustion, as it is very long, affording plenty of room.



Pinther Apparatus.



Schwartzkopff Apparatus.


13'4"
Double Burner with Cone Separator.
10" Channel Bar. One on each Side, i.e. at each End of Arch, one End to go under the Angle Bar at Corner of Combustion Chamber.
14" × 14"
Spring of Arch
Air
Side Observation Doors

Doelger Powdered Fuel Installation.

Contact of coal particles with other bodies results generally in a lowering of temperature to such an extent as to make combustion impossible, and results in the virtual loss of any fuel which falls on to the lining, &c.

The time of combustion depends on the size of particles and the finer the grinding, other things being equal, the quicker and more perfect the combustion.

Failure to recognise that powdered coal must be burnt while in suspension, and the radiant heat of combustion utilised without substantial impingement of the flame, accounts in this author's opinion for the practical failure to use powdered fuel in boiler furnaces, although the form and proportion of the latter make the problem difficult. In nearly all cases where tried the burning coal dust has impinged on the furnace sides or bridge before combus-

tion was complete, resulting in waste, destruction of fire-brick linings, &c.

For cement burning the coal is crushed to break large pieces, passed through rotary cylindrical dryers (utilising waste heat) and passed into pulverising machines, being reduced to such a state that not less than 95 per cent. will pass a sieve of 100 meshes per lineal inch. Screw, belt and pan conveyers and dust-proof bucket elevators are used for carrying such fuel, the requisite for safe conveying being the prevention of an explosive mixture with air, so that if it should catch fire it will burn slowly.

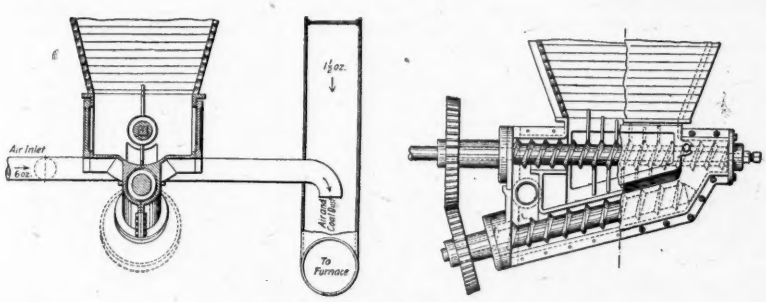
The paper by F. R. Low on the use of pulverised coal for steam making gives a good indication of the lines along which practical experimental work has been carried.

Three broad types of apparatus have been produced—the Pinther, in which the fuel is fed into a hopper above a feed control mechanism, and carried into the furnace by natural draught; mechanical feed apparatus, such as the Schwartzkopff revolving brush apparatus; and that in which coal is blown into the furnace as in the Day or Ideal apparatus.

With the first type efficiencies of from 75 to 80 per cent. were obtained, but the capacity was limited.

When fuel is introduced into a powdered fuel furnace at a rate which will give the full rated capacity of the boiler, a particle will remain in the combustion zone of an ordinary furnace less than half a second.

The relative volumes of equal weights of coal and air are about 1 : 990.



Culliney Feed Controller.

Not much less than 15 lb. of air per pound of coal would be required, so the relative volumes of coal and air introduced would be 1 : 14,850, and the diameter of the globe of air which would accompany each fuel particle into the furnace would be over 24 times the diameter of the particle, so that plenty of air may be used for fuel injection purposes without exceeding the supply required for complete combustion. In all the systems at present in use, the fuel is introduced in this way, the blower usually being so combined with the pulveriser that the powdered fuel is blown into the furnace as soon as it reaches the necessary degree of fineness.

In the late nineties Wegener tried in the States a natural draught system, and obtained boiler efficiencies of 75 to 80 per cent.

In 1910 Blake equipped a 300-H.P. water-tube boiler at Pittsburg; the pulveriser served as its own blower, sending the mixture of fuel and air into the furnace through a series of nozzles extending across the furnace front. A little less than the rated boiler H.P. was obtained with an efficiency of about 79 per cent.

In a later Blake apparatus installed recently at the Peter Doelger Brewery, New York, the coal was delivered into an extension furnace and smokeless combustion and high efficiency were obtained, but trouble with slag accumulation on the roof and furnace sides, entailing shutdowns for removal and excessive maintenance, also the cost of pulverising, led to the plant being shut down after eight weeks' trial.

In practice the boiler evaporated as much water from 1,000 lb. of powdered coal as from 1,400 lb. of natural coal.

In the Culliney feed controlling device, patented in 1905, the powdered fuel falls from a hopper on to a horizontal screw conveyer, which delivers it so that it falls past the blast pipe opening and a cross current of air in the latter carries a portion of it to the furnace pipe where another air current carries it to the furnace. Fuel falling past the blast opening is picked up by the lower screw conveyer (of coarser pitch) and returned to the upper conveyer.

Radial arms, fitted to the latter, agitate the fuel in the hopper and push any foreign material to the sides. This controller system has been applied to a 300-H.P. Franklin boiler and has resulted in complete smokeless combustion, no slag, several furnace linings melted down but inability to get full boiler capacity, this latter due to limited controller capacity.

In the Bettington boiler (made by Messrs. Fraser & Chalmers) which has been introduced into South Africa, Great Britain and Canada, the fuel is fed upwards through a water-jacketed nozzle in the centre of a vertical furnace. The pulveriser acts as a blower, and the air supply is preheated by the escaping products of combustion.

From the pulveriser the coal passes to a separator, the finer fuel passing to the burner. The blast opposing gravity tends to keep the fuel in suspension; the flame does not lift more than 10 per cent. under the highest rate of feed. The tubes round the furnace are covered with refractory material to within a short distance of the lower (mud) drum, and this wall tends to become coated with molten ash and slag, any ash carried with the draught falling into the pit.

A user of these boilers says that despite the cooling effect of the tubes, furnace linings quickly burn away; the makers claim that they will last two years. The pulveriser beaters and liners require renewal at each 1,500-2,000 tons of material handled.

The use of heated air allows coal of 15 per cent. moisture being satisfactorily handled, and 2 or 3 per cent. of the boiler capacity is allowed for pulverising.

A boiler of 2,600 sq. ft. heating surface has been running for over four years at the maker's works, evaporating regularly 14,000, and occasionally 22,000 lb. of water per hour. Tests of a Rand boiler of this type show an efficiency of 82·6 per cent.

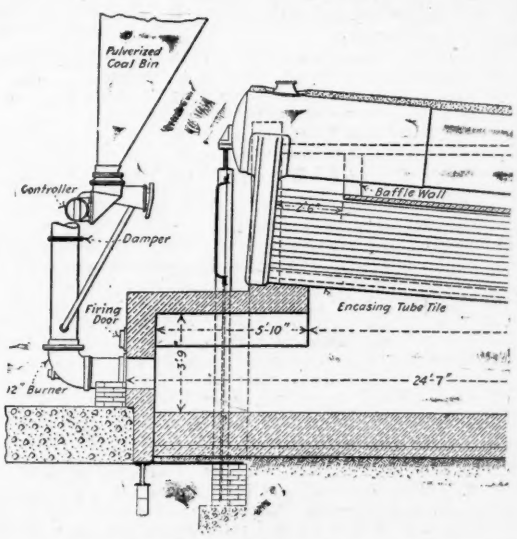
With ordinary methods of coal burning, the grate with its bed of incandescent fuel offers a varying resistance to the passage of air, rejects the incombustible residium with difficulty, and allows unburned fuel to sift to the ashpit and be fused in the clinker.

If fuel can be burned in suspension many of these difficulties disappear, and the draught producing apparatus is reduced to that which will remove the products of combustion and allow enough air to enter to burn the fuel.

There remains the difficulty of getting rid of incombustible, which if in pulverised form, is carried into the flues and out of the chimney, and if fused, attaches itself to the furnace sides, &c., damaging brickwork, and needing lay-offs for cleaning. Perfect and smokelese combustion can be obtained, but with the rates of combustion demanded in present practice, the result is a high temperature with erosive and reducing characteristics, which are not suited to a boiler furnace. Pulverised coal can be safely conveyed *en masse* in suitable holders, screw conveyers, &c. In those systems where the pipe back of the blower is filled with an explosive mixture of coal and air, the rate of flow must exceed that of the propagation of flame in such a mixture, and in shutting down, the coal supply must be shut off first. The pulverised mass will run like water, so that the pitch of chutes, conveyors, &c., must provide against the flowing of their contents.

Anthracite dust burns more slowly than coal having a higher percentage of volatiles, and must be very finely pulverised. With an ordinary fire-brick furnace well heated up there is no trouble in maintaining a steady flame, and this will re-ignite after having been turned out for several minutes. The cost of pulverising and the large initial cost of drying, pulverising, conveying and feeding plant, together with the fact that coal of practically all grades can be burned with a tolerable degree of smokelessness in the cheaper apparatus in common use with a degree of efficiency which leaves little margin to cover the increased expenditure, have combined to restrict the use of pulverised coal to boilers for special purposes.

The paper by Messrs. Dalton and Quigley deals with the substitution of powdered coal for oil in furnaces for heating blanks for forgings, and describes the coal milling and distributing plant employed.



Franklin Boiler and Powdered Fuel Furnace.

The Culliney fuel-feed controller is used, and the results show a saving of over 50 per cent. in operating cost as compared with the use of oil.

From a discussion in connection with this subject, which took place on certain selected topics, it appears that storage bins for

coal dust should have steep sides to prevent bridging over of the contents and stoppage of the flow; from 12 to 24 hours' storage is regarded as sufficient and absolutely safe, and one contributor finds by experience that at the end of 96 hours spontaneous combustion is likely to take place, while another mentions 10 days. A lighted match will often ignite the dust, but it simply smoulders away harmlessly.

The coal can be safely stored if thoroughly dry and at a comparatively low temperature. The bin should be as air-tight as possible and of a triangular cross-section, in the form of a trough with the conveyer in the bottom.

The coal should be dried to 1 per cent. or less before pulverising, and ground so that 95 per cent. will pass a 100-mesh screen.

The rough cost of grinding 150 tons per 24 hours may be taken at 40 cents a ton, and a contributor mentions that 17 H P.-hours per ton were required for grinding, &c.

The danger of particles of dust floating in the air is pointed out, and, therefore, the need for enclosure to prevent escape of dust.

The coal should be handled as a solid material, not in the shape of a dust cloud; aerial propulsion for transfer of powdered fuel should be avoided. One contributor points out that a powdered fuel furnace should have a temperature of at least 2,000° F. throughout, and a combustion space of at least 1 cb. ft. for each 3 lb. of coal burned per hour.

The boiler, is, however, essentially a low temperature furnace, seldom going over 1,500° F., and it does not offer the requisite combustion space out of contact with boiler surface. Moreover, the cost of grinding eats up any small advantage in economy over ordinary mechanical stoking. It is suggested, however, that powdered fuel would be of great value for peak loads in central stations, the furnaces being made automatic.

Slag is formed more easily at high than low temperatures, and serious results can be avoided by control of the burning mixture; furnace temperatures can be varied from 1,800 to 3,500° F., and with preheated air it is suggested that lower temperatures can be controlled provided the temperature of the furnace is above the kindling temperature of the fuel.

Summarising the matter in regard to furnaces generally, the saving by the use of powdered coal, according to one contributor, is due to practically perfect combustion, no handling of coal or ash, no poking or clinkering, and a constant and uniform heat resembling a gas fire, and as easily controlled.

The chief item of expense is the cost of preparing the coal; the all-round labour cost is much reduced.

It is further suggested that the trend of experiment should be to develop a furnace and a refractory material to withstand heat; under such conditions the ash would be slagged, and the design should provide for its removal. Then high capacity and efficiency would be obtained.

Past investigators have, no doubt, considerd this impossible, but that does not prove that it will not be accomplished.

ATOMS AND ELECTRONS.

At the meeting of the British Association in Sydney, Sir Ernest Rutherford, himself a New Zealander, gave a lecture on "Atoms and Electrons." We are indebted to a local newspaper for the following particulars:—

Science, the lecturer began, believed that everything on earth was ultimately divisible into tiny particles called atoms. The atom was considered the one permanent thing in the whole universe. But now it was discovered that the atoms themselves were divisible into collections of still smaller particles—electrons. First came Crookes's experiment, in which electricity was passed through a tube from which the air was gradually exhausted. The lecturer repeated the experiment.

Crookes considered that the rays produced consisted of matter in a new or fourth state. In 1897 Sir J. J. Thomson found that they consisted of a stream of negatively charged particles shot out at enormous speed—as much as 50,000 miles per second. He also found out that the mass of these flying particles was only one eighteen-hundredth of that of an atom of hydrogen. They were the electrons of which the atoms were made up. They were liberated from substances in various ways. Every electric lamp liberated electrons, and they were thrown out at enormous speeds by radio-active substances. An electron was simply a unit of electricity apart from matter. It had nothing of the ordinary atom of matter associated with it.

This discovery altered all existing ideas of the structure of things, and of the connection between matter and electricity. But the atom itself remained the same—even after an electron had left it. With atoms of certain substances, however, such as radium, it was different. Their life was limited; they tended to break up and disappear. Radium shot off, among other things, a stream of tiny particles—"alpha particles"—which travelled at about 10,000 miles a second, and consisted of a particle of the rare gas helium, together with a charge of electricity. Helium and radium being different, this amounted to a transmutation of elements. When the radium atom had fired off its particle of helium, it became a quite different substance, and that in turn became another through a long series of changes, beginning with uranium. Some of the links in the chain had a life of only a few minutes, whereas uranium would last as long as five thousand million years. Most of these "transition elements" were discovered in Sir Ernest Rutherford's laboratory, by himself and his assistants.

It was possible, Sir Ernest went on, that the atoms of every substance had a similar tendency to break down, but their life was so long that no change in them was noticeable. The tranformations of the atoms of radio-active substances could not be controlled by man, though the energy set free was enormous—from three to 10 million times as great as by our most powerful explosives.

It had been thought that we should never be able to reach the atom—it was so small. But actually the tracks of some atoms had been registered in various ways. The alpha particles shot out of radium—atoms of helium—caused a gas to conduct electricity, "ionised" it, and by several ingenious contrivances the setting up of this ionisation was used as a means to register the passage of the alpha particles through the gas. One means—a string electrometer—had been invented by Prof. Laby, a Sydney University graduate. The ionisation of the gas caused by the passage of the alpha particles caused this string to vibrate, and thus a record was set up, in which each vibration represented an atom.

Sir Ernest went on to the structure of the atom. At the centre, he explained, was a nucleus, almost as tiny as an electron, and containing a positive charge of electricity. Round about it, in concentric rings, circled the electrons, with their negative charges. The nucleus was so small and the electrons were relatively so far from it that if it were taken as represented by an ordinary table glass, some of them would be miles distant from it, so that the atom was actually very far indeed from "solid" in the ordinary sense. The arrangement of the electrons in an atom depended on the charge carried by the nucleus; and it had been suggested that the smallest atom—of hydrogen—consisted of one charge and one electron, and that gold, for instance, consisted of 79 charges and 79 electrons.

Hitherto the ground had been familiar to the scientific members of the audience. But now Sir Ernest reached a boundary line, over which, he said, some of his scientific friends would not follow him. He said that the element lead might have either of two origins, and, according as it originated in one way or another, its atomic weight might vary. There might be, apparently, a couple of pieces of lead, which looked just the same, and yet their physical qualities would be quite different. That, perhaps, would not be believed now, but it would be later on. The nucleus of an atom might differ in different atoms, though their chemical and physical properties were the same. And gravitation itself was most probably a property of the nucleus. In a heavy atom it would be most complex, and bound together by most powerful forces. It would be the work of the future to explore it, as the rest of the atom had been explored.

A vote of thanks was carried with enthusiasm, on the motion of Sir Oliver Lodge, who said that Sir Ernest Rutherford had described what might be called the astronomy of the atom, and it was found that through it, as through the visible universe, law reigned. Personally, he did not think that, apart from the relation to the body of man, there was such a thing as "great" or "small."

BUSINESS NOTES.

Book Notices.—"Useful Arts Catalogue, 1903-1914." The Public Libraries Committee of Newcastle-upon-Tyne has just issued this new catalogue, edited by the public librarian, Mr. Basil Anderton, M.A. The catalogue is based on the decimal system, and is admirably arranged and classified; the sections relating to engineering naturally occupy a large proportion of the volume, and a very useful collection of books on electrical subjects has been brought together during the past 11 years. We commend to the notice of other librarians the excellent example of the Newcastle Committee and librarian; every large city should be provided with a library containing a complete series of works on arts and industries, which are immensely more valuable to the community than a vast accumulation of novels and light literature.

"The *Mechanical World* Pocket Diary and Year Book for 1915." Manchester: Emmott & Co., Ltd. Price 6d. net.

The Telegraph and Telephone Journal. Vol. I, No. 2. November. The Editing Committee, G.P.O., North London, E.C.

A special number of the *Asteroid*—the official magazine of the B.T.H. Social Club—contains a Roll of Honour occupying many pages, and containing the names of about 1,000 employés of the company, who have joined the Colours. This is a remarkable record, and does credit to the patriotism of the staff. The issue contains a variety of amusing items, including the illuminating discovery that B.T.H. is "the backbone of BriTieH!"

Dissolutions and Liquidations.—Stellar Signs, Ltd.—This company is winding up voluntarily, with Messrs. A. C. Hutchins, of 11, Pancras Lane and V. G. Morris, of Wardrobe Chambers, Queen Victoria Street, E.C., as joint liquidators. A meeting of creditors is called for November 11th.

S. Pontifex & Co. & T. S. Borradaile, electrical engineers and contractors, Regnart Buildings, Euston Street, N.W.—Messrs. Frederick Wm. and Thomas Wade-Lennard have dissolved partnership. Mr. F. W. Lennard will attend to debts.

Canada.—An Ontario agent wishes to represent British manufacturers of electrical, contractors', and engineers' supplies. Firms should write to H.M. Trade Commissioner for Canada, 3, Beaver Hall Square, Montreal.

Catalogues and Lists.—British Thomson-Houston Co., Ltd., Rugby.—Price list No. 8,112 contains a brief illustrated description, with dimensioned diagrams and prices, of the B.T.H. combined switch and fuse for tramcar lighting.

Messrs. Krupka & Jacoby, Ltd., 39, Victoria Street, London, S.W.—Two price leaflets, one relating to 600 megohm cable, and the other to English lampholders and ceiling roses.

British Prometheus Co., Ltd., Salop Street Works, Highgate, Birmingham.—Twenty-four-page booklet containing half-tone views of the various departments at the works, with the manufacture of electric heating and cooking apparatus in progress. Alternate pages give illustrations and prices of irons, toasters, liquid heaters, kettles, hot cupboards, "Simplicity" cookers, radiators, and other apparatus.

Messrs. Hogan & Wardrop, 2, Gresham Buildings, Basinghall Street, London, E.C.—Thirty-page well and fully illustrated catalogue of electric fans (desk, bracket, ceiling, punkah, porthole, &c.), automatic shutters and regulating resistances, small power motors, grinding and polishing machines, and sewing machine motors. In each case tabulated matter relating to sizes, speeds, weights, prices, code-words, &c., is very plainly set out.

Messrs. R. H. Patterson & Co., Ltd., Forth Street Works, Newcastle-on-Tyne.—October catalogue of new and second-hand machinery for sale or hire.

Messrs. E. Brook, Ltd., Colne Road, Huddersfield.—November stock list of single, two and three-phase motors.

Trade Announcements.—The British Electrical Export Co., Ltd., concerning which a registration notice appeared in our last issue, has been formed, with offices at 27, Martin's Lane, London, E.C., for the purpose of assisting smaller electrical manufacturers who have not branches in the foreign markets to get into touch with shipping orders at present on the market that have previously gone to German houses.

Messrs. H. R. Cleave & Co., of Bristol (Messrs. Drake & Gorham's agents), are opening a branch at 15, Summer Row, Birmingham, where Mr. Ernest G. Roberts, who has been connected with Mr. G. Braulik for several years, will act as their resident manager. He will hold large stocks of Conference lamps.

No Connection.—The Alpha Manufacturing Co., of Balham, S.W., write to say that they are in no way connected with the Alpha Electrical Co., Ltd., whose registration was announced in our last issue.

Bankruptcy Proceedings.—Trubie Moore, electrical engineer, Leeds.—Last day for proofs for dividend, November 16th. Trustee, H. Clifford Bowling, 24, Bond Street, Leeds.

LIGHTING and POWER NOTES.

Aberdeen.—The Electricity Committee reports that during September 957,906 units were generated, an increase of 77,973 units on the same month of last year.

Accrington.—Street Lighting.—The lighting superintendent has been instructed to prepare an estimate of the cost of lighting Burnley Road by electricity on the same system as the lighting of Blackburn Road.

Aldershot.—School Lighting.—The Education Committee has decided to defer fixing new incandescent gas lamps in the West End Schools, until estimates are received for installing electric light.

Ashford (Kent).—Prov. Order.—The East Ashford R.D.C. has decided to agree to the revocation of the Ashford E.L. order which concerned a portion of the Council's district.

Australia.—The North Illawarra Council, N.S.W., is considering the question of an electric light installation, and is in communication with the Public Works Department as to obtaining current from the power house at Port Kembla, which is to operate the new coal shipping jetty appliances.—*Australian Mining Standard.*

The Doncaster (Vic.) Shire Council proposes installing electric light throughout the municipality; current will be purchased in bulk from the Melbourne City Council. Mr. V. J. Crowley has been appointed consulting engineer to the scheme.

Barking.—The U.D.C. has decided not to give financial assistance to the Ilford U.D.C. in its action with the Ilford Gas Co., and with regard to the I.M.E.A. Private Bill, the Council requires further particulars as to the cost before coming to a decision.

Belfast.—Extension Scheme.—The Electricity Committee has adopted the report of the city electrical engineer on the proposed extension of the Corporation electricity undertaking, and the recommendation has been considered at a special meeting of the Council.

The special meeting of the Council on the 29th ult. decided that in view of the difficulty at the present time of obtaining money at a reasonable rate, the erection of the new electricity generating station should be postponed, and that in order to meet the requirements of the next three years, alterations and additions be carried out to the plant in the existing works, and that a sub-station be provided and necessary cables be obtained, &c., at a cost of £35,000.

Cardiff.—At the meeting of the Electric Lighting and Tramway Committee, it was reported that an agreement had been concluded between the Corporation and the Postmaster-General for the supply of energy to the Cardiff Post Office for a period of 10 years.

Chester.—Year's Working.—At a recent meeting of the T.C., it was pointed out that as a result of 23 weeks' working there was a profit of £1,811 on the hydro-electric works, and on the whole of the electricity undertaking the net profit for the year had been £4,961, of which £1,094 was transferred in aid of the lamp rate, £500 to the improvement rate, and £3,339 to capital account.

Chile.—A decree approving the project of Senores Emilio Rodriguez and Eduardo Arzon for the establishment of an electric lighting system in the town of Curepto has been granted.—*Board of Trade Journal.*

Cleethorpes.—Street Lighting.—The U.D.C. has decided to have the lamps in certain streets lit by electricity as an experiment, the lamps to have test meters attached, so that the result can be decided by the Lighting Committee.

Clevedon.—Convalescent Home Lighting.—At this Home recently the ordinary gas lighting installation, consisting of 36 vertical mantles, with a total of 900 c.p., has been superseded by a Lister-Bruston automatic electric plant, with the engine running on town gas, and supplying 60 16-c.p. metal lamps giving a total of 950 c.p. With incandescent gas burners, the March, June and September quarters of 1913 called for a gas consumption of 161,500 cb. ft. of gas, while the same quarters of 1914, using the gas-engine electric plant, only required the consumption of 89,100 cb. ft. of gas, showing a saving of 72,400 cb. ft., in addition to the advantages of electric light.

Connah's Quay.—Prov. Order.—The U.D.C. has decided to include in the area of supply under the prov. order its own district, and the parishes of Loughton, Northop, and Leadbrook Major and Minor, in the area of the Holywell R.D.C. The latter body has consented to the inclusion of the rural parishes, provided the Northop Parish Council approves.

Deal.—Prov. Order.—The T.C., on being informed that the Walmer U.D.C. had decided not to co-operate in applying for a prov. order for electric supply, resolved to take no further action in the matter.

Dover.—The Postmaster-General has agreed to accept the following terms for the supply, by the Corporation, of energy to the new post office:—Up to 8,000 units per annum (minimum), 5d. per unit; 8,000 to 12,000 units, 4½d.; beyond 12,000 units per annum, 3½d. per unit, the terms to be for one year.

Durham.—School Lighting.—The County Education Committee has decided to have the electric light installed at the Industrial School premises.

Eastbourne.—The Electricity Committee has resolved to give electricity free to houses occupied by the Belgian refugees as long as the amount consumed is reasonable.

Edinburgh.—Half-Watt Lamps.—At a recent meeting of the T.C., it was reported that out of the 682 public electric lamps in the city over 260 had been changed to half-watt lamps, thus doing away with the carbons altogether. The lamps were being changed at the rate of 40 or 50 per week.

Greenock.—The electricity sub-station at Bay Street, for the supply of electricity to Port Glasgow, is now completed, and current was to be switched on on Monday last. Sub-stations are now completed at the shipbuilding yards of W. Hamilton & Co., Dunlop, Bremner & Co., and Russell & Co., and cables are being laid to the Clyde shipbuilding yard.

Hendon.—The Education Committee has decided to have electric light installed at the Wessex Garden School.

London.—Bethnal Green.—The Electricity Committee of the B.C. is about to carry into effect the scheme adopted by the Council for the supply and distribution of electricity within the borough. The specifications and conditions have been prepared by Mr. Couzens, the consulting engineer, and tenders will shortly be called for. The question of a site in the West Ward suitable for a sub-station is under consideration.

Hammersmith.—The B.C. has decided to supply current to the London Territorial Association at the Exhibition Buildings, Wood Lane, at 1¼d. per unit between sunset and midnight, and 9d. per unit between midnight and sunset.

Marylebone.—The Electric Supply Committee of the B.C. reports that in the arbitration proceedings with the Electrical Power Storage Co., Ltd., in connection with the agreements with respect to the maintenance of two storage batteries at the Rathbone Place and Manchester Square sub-stations, terms favourable to the Council were secured.

We are informed by the Westminster Electric Supply Corporation that the Church Army Hut in Grosvenor Square, which is being used by the Territorials, has been equipped with electric cooking apparatus, and that the whole of the cooking for 300 men is now carried out by electricity.

London Electricity Supply.—In a report on proposed legislation in connection with the above scheme, the Special Committee of the L.C.C. states that it has conferred with practically all the companies and authorities concerned and submits certain particulars of the scheme, for which it is suggested Parliamentary authority should be sought. It is urged that steps should now be taken so that the scheme can be launched at a favourable time without delay; this would enable action to be at once taken in directions not involving capital expenditure, but which would materially facilitate the carrying out of the scheme when necessary. The proposals follow practically without modification the report of July last (see Electrical Review, page 198), and so far as their effect on existing undertakings is concerned, it is pointed out that the only compulsory powers which it is proposed to confer upon the new authority are designed to prevent individual supply authorities from incurring capital expenditure in laying down plant or other works which, in the opinion of the B. of T., are definitely unsuitable to an ultimate scheme of uniform supply throughout the area. The importance of obtaining powers for railway supply is emphasised. It is now proposed that the proportions in which capital shall be raised by the authority and company should be a matter of agreement between them. The authority would have power to discharge its capital liabilities by the issue of stock and the company by the issue of shares.

The Finance Committee, in dealing with the scheme in its financial bearings, considers that no heavy capital expenditure would be involved till nearly 1920, if conditions were adverse—five years being allowed to bring the Act into operation. Recent loan periods have been reduced owing to probable obsolescence arising from such a scheme as is proposed; it is, therefore, considered that the periods may be longer with the new scheme, which will be free from this particular risk.

From previous experience it is assumed that the cost of an inquiry, such as this, lasting 30 days, including experts' fees, will amount to about £17,000; from the present up to second reading stage £5,000, and from that stage onwards, £12,000. In this connection the Committee suggests that depending on the likelihood of the powers being obtained, it will not be necessary to incur the full liability until after the second reading.

Maidstone.—Proposed Loan.—The T.C. has applied to the L.G.B. for a loan of £800 for extensions at the electricity works. A 150-kw. set at the works has been disposed of to the Russian Government for £700.

The Electricity Committee is considering the question of bonuses with a view to increasing the salary of the electrical engineer.

Midhurst.—E.L. Scheme.—The E.L. Committee of the R.D.C., on October 28th, presented a report as to the mains of the E.L. Co., and recommended that underground mains be insisted upon in certain portions of the parishes. The report was adopted, and it was stated that the E.L. Co. acquiesed in the decisions.

Middleton.—Upon the recommendation of the E.L. Committee, the T.C. has decided to apply for sanction to discharge the accumulated debit balance of £1,815 by six yearly instalments commencing on April 1st next.

Middlesbrough.—The Gas and Electric Lighting Committee has sanctioned an agreement with the Cleveland and Durham Electric Power Co., under which the rights of the company for the supply of electricity to North Ormesby are transferred to the Middlesbrough Corporation.

New Zealand.—The ratepayers of Pahiatua have approved the raising of a loan of £10,000 for electric light and power works in the borough.—*B. of T. Journal.*

North Bierley.—Workhouse Lighting.—The L.G.B. has sanctioned a loan of £1,260 for the purpose of lighting the Union premises with electricity.

Oldham.—Cooling Towers.—Objections having been made to the proposed erection of cooling towers at the Greenhill electricity works, the Electricity Committee has considered the question of erecting ornamental towers, but has decided that this cannot be done, as it would be very expensive; the Committee has also expressed the view that the height of the towers cannot be further reduced without the efficiency being greatly impaired.

Shipley.—Extension of E.L. Area.—The U.D.C. has decided to apply for power to supply electricity in the Baildon district.

Skipton.—Prov. Order.—The U.D.C. has decided to apply to the B. of T. for a prov. order to supply electricity in the district, and Mr. W. Emmott, of Halifax, has been appointed engineer to the scheme.

Southampton.—The Electricity Committee has under consideration the question of giving a supply of current to Melbourne Street, which will necessitate an extension of mains at a cost of about £1,300.

The surplus on the year's trading of the electricity undertaking amounted to £19,164. This is a decrease on the surplus for the year 1912-13, which was £20,286.

Southend-on-Sea.—The district auditor has disallowed the sum of £100 charged in the electric lighting accounts as expenditure incurred by the Electricity Publicity Committee in connection with the exhibit of an electric house at the Kursaal.

Torpoint.—Public Lighting Arbitration.—As a result of arbitration between the U.D.C. and the Electric Supply Co. respecting public lighting, the award has been given in favour of the Council, the company to pay £100 damages and £31 13s. costs.

U.S.A.—New York Public Lighting.—With a view to reducing the cost of public lighting, the city authorities propose replacing the street arc lamps with nitrogen filled (half-watt) tungsten lamps. About 500 such lamps of 400, 500 and 750 watts have been installed in some of the principal streets of Manhattan for comparison with the arc lamps which are in general use. The New York Edison Co. has submitted tentative prices for the 750-watt lamp, $107, as against $120 a year for flame arc lamps; 500-watt lamp, $85, against $90; 400-watt lamp, $77, to replace arc lamps at $99. These prices are based on four renewals a year, but up to the present more renewals would be wanted, and the price would need to be raised. One-year contracts are held with the electric companies, and, if the new lamps are adopted, the present arc lamps, which are modern, will have to be scrapped.—*Elec. World.*

Wolverhampton.—The Council has decided to pay £500 to the Midland Electric Corporation for the acquisition of the right of the latter to supply electrical energy in the parish of Bushbury.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The deadlock over the Corporation provisional order in its relation to the tramway profits has now been removed. It is understood the Scottish office has agreed to allow the order to proceed on the understanding that the T.C. may devote the tramway profits to the common good to the extent of £2,000.

Australia.—Representatives of the City, Borough and Shire Councils in the vicinity of Geelong (Victoria) are considering the question of buying out the Geelong electric tramways and running them as a municipal enterprise.

The Malvern Tramway Trust (Vic.) has arranged to carry out the construction of the Malvern Road tramway section, at a cost of £27,540, and various other tramway works are to be carried out.

The consulting electrical engineers to the Northern Tramway Extension League, Victoria, have submitted their report on the proposed electric tramways in Fitzroy, Northcote, and the shire of Preston. The length is 5 miles 60 chains, and the estimated cost is £95,271.

Bolton.—Tramway Reconstruction.—The work of reconstructing and doubling the track in St. Helens Road between Daubhill car shed and Four Lane Ends is to be commenced during this month.

Bury.—Proposed Tramway Extensions.—The T.C. decided on October 29th to apply to the B. of T. for powers to extend the tramways to Walmersley and along Rochdale Old Road, from the terminus at Jericho to the borough boundary.

Continental Notes.—Holland.—The Amsterdam municipal tramway receipts for August and September show a falling off of nearly 20 per cent., as compared with 1913, the figures being for 1914 643,673 guilders, and for 1913. 812,753 guilders.

A concession has been granted to the Eerste Nederlandsche Electrische Trammaatschappij for the construction and working of electric tramways from Haarlem to Bloemendaal and from Haarlem to Overveen.—*Board of Trade Journal.*

Spain.—A concession has been granted to Don José F. Solorzano y Frure for the construction of an electric tramway from Ferrol to Santa Maria de Neda.—*Board of Trade Journal.*

Edinburgh.—Proposed Tramways.—The T.C. has adopted the recommendation of the Tramways Committee to include in the provisional order to be promoted in next Session powers to construct a tramway to Corstorphine, and to carry out other important extensions.

Liverpool.—The City Council has decided that the Tramways Committee shall cease all dealings with Thermit, Ltd., and the Tudor Co.

London.—The Westminster City Council, last week, refused to consent to the L.C.C.'s proposal to link up the tramways at Victoria Station and Westminster Bridge by means of a line along Victoria Street.

The London United Tramways Co. has decided to inaugurate a system of half fares for children under 12 years of age, during the hours from 8.30 a.m. to 5.30 p.m. on week days, and on Saturdays to 2 p.m.

Rotherham.—The T.C. is to seek compulsory powers for through running of tramcars between Sheffield and Rotherham, also the doubling of the tramway track in Effingham and Frederick Streets, and the extension of the present tramway in Broom and Wickersley Roads.

Southampton.—Year's Working.—The surplus on the year's working of the tramway undertaking amounts to £24,077, showing an increase of £4,592 over the surplus for the previous 12 months.

U.S.A. Electric Vehicle Association.—The Electrical Vehicle Association of America is reported to be considering a proposal to organise a trans-Continental trip of an electric motor vehicle during the course of next summer.

TELEGRAPH and TELEPHONE NOTES.

Alien Telephone Inspector.—An Austrian, named Deigel (or F. E. Roberts), employed as a telephone inspector at Wanstead telephone exchange, was charged on October 31st with failing to register, and was sentenced to three months' imprisonment.

Alien's Wireless Installation.—On October 29th, at Woolwich, H. Focktenberger was charged with failing to register as an alien, and with having in his possession wireless telegraph apparatus. He was remanded in custody.

Marconi Shares.—On October 30th an action was brought by Mr. S. Segar in the King's Bench Division against Mr. Godfrey Isaacs, managing director of Marconi's Wireless Telegraph Co., Ltd., to recover money lost in connection with the sale of a large number of Marconi shares under an alleged verbal agreement, the existence of which was denied by the defendant. The plaintiff stated that his total losses amounted to about £32,000. He also claimed that the defendant, as director of the English Marconi Co., diverted from that company profits in which the plaintiff, as a shareholder of the company, ought to have participated. Evidence was given by Mr. Segar in support of the charge, and he was afterwards cross-examined. On Monday the hearing was resumed, and the evidence of Sir Thomas Berridge was taken. The case for the defendant was then opened, and Mr. Godfrey Isaacs was called; his cross-examination was begun, and was continued on Tuesday. The hearing was adjourned.

Rochford.—The Board of Guardians has decided that a system of intercommunication between the various buildings at the workhouse by telephone shall be installed, at a cost of £104 10s.

Secret Wireless Stations.—In reply to numerous applications from wireless amateurs for leave to use their installations for the detection of secret wireless stations, the Admiralty has announced that such permission cannot be given; the successful detection of illicit wireless telegraph stations depends on the careful collation of relevant observations, and it is obvious that a small and select body of observers can give much better results than a very large number who have not the necessary knowledge of the circumstances. Illicit wireless telegraph stations to be dangerous must be capable of sending a considerable distance, and although it is true that reception can be carried out to some extent without a formal and visible aerial, yet transmission to any serious extent would be impossible.

Telegrams in Code.—It is announced that code telegrams cannot be accepted for Venezuela, Curacao, Hayti and San Domingo.

War Tax on Telephone and Telegraph.—American telephone and telegraph companies will be put to considerable trouble by the "war revenue tax Bill" which the Government have found necessary because of the falling off in Customs receipts. Under this Bill these companies will be obliged to collect a tax of 1 cent on each telephone and telegraph message for which they charge the sender 15 cents or more.—*Electrical World.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—November 19th. Six or twelve months' supply of telegraph material and other supplies, for G.N. of Scotland Railway. Particulars, &c., from Stores Superintendent, 80, Guild Street.

Atherton.—November 18th. One 250-kw. single-phase transformer. Mr. C. T. Astbury, Resident Engineer. The D.C. has also decided to provide another panel for fixing to the E.H.T. board to control the spare transformers.

Australia.—Melbourne.—December 16th. Victorian Railways. Rubber-covered copper wire. Contract No. 27,705. Contractors' Room, Spencer Street.

December 16th. Victorian Railways. 100 neutral track relays for electrical circuits. Contract 27,712. Contractors' Room, Spencer Street.

December 28th. Victorian Railways. Three 50-kw. static transformers. Contract 27,727. Contractors' Room, Spencer Street.

Adelaide.—December 9th. Telephone instruments and parts, for the Postmaster-General. See "Official Notices" October 23rd.

Brisbane.—December 15th. Switchboard, common battery, automatic or semi-automatic, for the Postmaster-General. See "Official Notices" October 9th.

Sydney.—December 9th. P.M.G. Various telegraph instruments and measuring instruments.

December 21st. City Council. Motor-generators and switchgear suitable for electric vehicle battery charging. Specifications, 10s. 6d., from City Electrical Engineer.

Brisbane.—January 6th. P.M.G. Paper-insulated, lead-covered cable (Schedule 328). See "Official Notices" to-day.

The P.M.G. for Australia announces that it has been decided to extend the date for the receipt of tenders to Schedules 304, 310, 311 and 316 to January 13th, 1915, and to cancel the invitation for tenders to Schedule 314.

Barnet.—December 7th. Steam boilers and heating and warming plant, electrical power and lighting plant, electric lift, water-softening plant. Messrs. Williams & Cox, architects, 34, Henrietta Street, W.C.

Blackpool.—November 19th. Corporation. Water-tube boiler, mechanical stokers, economiser, steel chimney, coal-storage hopper, one 1,500-kw. turbo-alternator, surface condenser and auxiliaries. See "Official Notices" October 23rd.

Chatham.—November 11th. Corporation. Twelve months' supply of incandescent electric lamps, stores, &c., for the Corporation. Forms of tender from the Borough Surveyor's Office, Town Hall.

Croydon.—November 17th. Two electric motor pumps and connections, at South Norwood Sewage Farm. Particulars from Borough Engineer's office, Town Hall, Croydon.

Dartford.—November 18th. U.D.C. Steam exhaust and other piping, extension of H.T. cubicles, control board and cabling. See "Official Notices" to-day.

Dublin.—November 9th. Dublin United Tramways Co. Twelve months' supply of stores, including car fittings, electric supplies, &c. See "Official Notices" October 23rd.

Corporation. Electric time switches for street lamps, and radial wave reflectors. See "Official Notices" to-day.

Hawarden (Flint).—November 11th. R.D.C. Gas engines, suction gas plant and dynamos, switchboard, balancers and boosters, storage battery, underground mains. See "Official Notices" October 23rd.

Manchester.—November 17th. Pitch for paving purposes, for the Tramways Committee. Mr. J. M. McElroy, General Manager.

Port Elizabeth.—November 26th. Municipal Council. (*a*) Engine-room plant, turbo-generators, H.T. switchgear, converting plant; (*b*) boiler-house plant, boilers, coal conveyor; (*c*) E.H.T. and telephone cables. See "Official Notices" to-day.

Spain.—November 10th. The Spanish Post and Telegraph authorities, Madrid. Concession for the construction and working, during a period of 20 years, of a telephone exchange in the town of Caceres.

November 11th. Spanish Post and Telegraph authorities, Madrid. Concession for the construction and working, during a period of 20 years, of a telephone exchange in the town of Puigcerda.

Tunbridge Wells.—November 7th. Corporation. 12 months' supply of H.T. and L.T. cables. See "Official Notices" October 9th.

Wakefield.—December 4th. Yorkshire (W.R.) Electric Tramways Co., Ltd. Twelve months' supply of electric lamps, fittings, insulating materials, &c. Schedules can be obtained from the Central Offices, Belle Isle, after November 9th.

November 10th. Twelve months' supply of coal at Calder Vale electricity works. City Electrical Engineer, Old Town Hall.

Walsall.—November 17th. Corporation. Extra-high-tension cables. See "Official Notices" to-day.

Wigan.—November 11th. T.C. 40 electric torches for the police. Mr. John S. Percival, Chief Constable.

York.—November 9th. Construction of about 1½ miles of light railway, excluding overhead electrical equipment, for the T.C. Mr. F. W. Spurr, City Engineer (returnable deposit £5).

CLOSED.

Aber Bargoed.—Messrs. Johnson & Phillips, Ltd., have received an order from the Rhymney Valley and General Electric Supply Co., Ltd., for overhead and underground cables, switchgear, &c., for Aber Bargoed.

Australia.—Albury, N.S.W.—The New South Wales Government has accepted the tender of the Brush Electrical Engineering Co. for generating plant, condensers and auxiliaries for the equipment of the Albury electricity supply station.

The following tenders have been accepted :—

Postmaster-General's Department, Sydney.—
Switchboard, Denchquin, £116 10s.; one ditto, Tamworth, £116.—Gardner, Waern & Co.

Postmaster-General's Department, Victoria.—
Switchboard cable, various, £771 16s.—British G.E. Co.
Petrol-driven desiccating plant, £169.—I.-R., G.-P. and Telegraph Works.
500 indicators, £87 10s.; 8,000 plugs, £488 6s. 8d.—J. Bartram & Son Pty.

Victoria Railway Department.—
Rolled-steel joists for electric car shed at Jolimont, £9 per ton.—Dorman, Long & Co.
Rolled-steel channels for the electrification of the suburban lines, £11 11s. 9d. per ton.—Gollin & Co. Pty.

Public Works Department, Victoria.—
50,000 porcelain insulators, £593 15s.—Lawrence & Hanson Electrical Co., Ltd. —*Tenders.*

Bradford.—Mr. Charles Bell has secured the contract for a full electric installation at the camp of the Miners' Battalion of the King's Own Yorkshire Light Infantry, which is being established at Otley.

Bury.—The T.C. has accepted the following tenders :—

Electrical Power Storage Co., Ltd.—Maintenance of storage battery at Rochdale Road power station.
Ferranti, Ltd.—Two 250-kw. transformers.

Dorchester.—The order for the gas engine and plant for the electricity works extensions has been placed with Messrs. E. S. Hindley & Sons. The engine will be one of their six-cylinder vertical type, 120 B.H.P., running at 500 R.P.M.

London.—The Metropolitan Asylums Board has accepted the tender of Messrs. Toy & Winslow, at £31 5s., for re-arranging the lighting in the yard at the head station.

G.P.O.—A six months' contract for the supply of Osram lamps has again been secured by the General Electric Co., Ltd.

Maidstone.—The T.C. received the following tenders for cables for extensions :—

Craig Park Electric Cable Co.	(accepted)	£651
W. T. Glover & Co.		709

Manchester.—The Tramways Committee has accepted the tender of Messrs. Estler Bros. for steel storage shelving at the Hyde Road car depôt.

The Education Committee has accepted the tender of Messrs. J. Bryden & Sons, of South Kensington, for lifts for various schools.

The following tenders have been accepted by the Waterworks Committee :—

Copper conductor.—Collier Bros., Manchester.
Cable.—H. Davenport, Whitefield.

The Libraries Committee has accepted the following :—

Alterations of and additions to the electric lighting installation at Openshaw Branch Library.—E. M. Evans.
Electric lighting at the Bradford Library, and also at the Carnegie Library, Didsbury.—Maitland & Co.

Northampton.—The Borough Education Committee has accepted the tender of Messrs. J. A. Baker & Co. for wiring the Girls' Secondary School for the electric light, and supplying lamps and fittings, at £122.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, November 7th. At 7 p.m. At Royal Technical Institute, Peel Park. Short papers by members (for gold medal).

Institution of Mechanical Engineers (Graduates' Association).—Monday, November 9th. At 8 p.m. At Storey's Gate. Paper on "Some Notes on the Wear and Tear of Boilers," by Mr. E. B. W. Maitland.

Institution of Electrical Engineers.—Thursday, November 12th. At 8 p.m. At Victoria Embankment, W.C. Paper on "Cables," by Mr. C. J. Beaver.

(Scottish Local Section).—Tuesday, November 10th. At 207, Bath Street, Glasgow. Inaugural address by Mr. J. Lowson.

Greenock Electrical Society.—Thursday, November 12th. At 7.45 p.m. At 21, West Stewart Street. Paper on "Rotary Converters," by Mr. P. C. Kerr.

Physical Society of London.—Friday, November 13th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "A Bridge for the Measurement of Self-Induction," by Mr. D. Owen, and "On the Coefficient of Diffusion in Dilute Solutions," by Mr. B. W. Clack.

NOTES.

Alien Names.—In order to include quite correctly in the Universal Electrical Directory all those whose names were legally altered before or after October 12th, it is requested that their old and new names, clearly written, shall be sent to the Directory Department, 4, Ludgate Hill, London, E.C., as soon as possible.

Range-Finder Wanted.—The Royal Naval Division Engineer Unit, in which so many electrical engineers have enlisted, is in need of a Barr & Stroud range-finder. The cost of such an instrument is about £50. In view of the close connection between this force and the electrical industry, it seems an admirable opportunity for some engineer or firm to provide it with an indispensable item of equipment. Offers should be addressed to Major Carey, R.E., Royal Naval Division Engineer Unit, Martin Mill, Kent, mentioning this journal.

Electrical Congress Postponed.—At the meeting of the American Institute of Electrical Engineers, held in New York on October 9th, it was announced that, upon the recommendation of the Executive Committee of the International Electrical Congress Committee on Organisation, the board of directors of the A.I.E.E. had declared the Congress to be postponed until such time as it might be found practicable to hold an International Electrical Congress in the United States. All subscriptions to the Congress will be refunded in full. It is probable that a meeting of the Institute will be held in San Francisco in June or September, 1915. —*Elec. World.*

A Large "Motograph" Sign.—A recent issue of the *Electrical World* describes what is claimed to be the largest "Motograph" sign in the world, which is installed on a five-storey Chicago building. In this apparatus the words move across the screen, enabling the spectator to read any desired message up to, say, 150 words. The sign structure is 145 ft. long and 50 ft. high; the moving letters are 12 ft. high. The lamps in the motograph panel number about 4,600, and are arranged in vertical lines on about 115 socket-boards, each supporting two rows of 20 lamps. In principle each lamp socket is wired separately to the motograph instrument, but in this sign there are four lamps to a switch, and over 80,000 ft. of wire has been used. The switchboard and motograph apparatus are housed in a roof structure, and operate automatically. In all, including fixed lamps, some 10,000 lamps are used, of 10 and 5-watt sizes. The Commonwealth Edison Co. has leased the new sign for some months; the American patents for the system are controlled by the Federal Sign System (Electric)

Patents and Alien Enemies.—Before the Comptroller-General of Patents, Mr. Temple Franks, and the ex-Comptroller, Sir Cornelius Dalton, at the Patents Court in London on October 21st, Mr. W. L. Turner, of 5, Castle Street, Liverpool, and Mr. H. A. Blackwell, of The Albany, Liverpool, applied for the suspension of two patents, dated 1901 and 1902, in respect of welding metal, and for the suspension of the trade-mark "Thermit," which is the trade-mark of the Thermit Co., Ltd., of 17, Martin Lane, Cannon Street, who carry on the process. The application was opposed by the Thermit Co.

Mr. Royston, on behalf of the applicants, said that the shares of the Thermit Co. were held almost entirely by German shareholders. Three directors, who lived at Essen, were removed from office on September 8th, 1914. The invention was largely used in this country for welding the joints of tramway lines, and the Liverpool Corporation had held up some of their work until they could ascertain where they stood. Applicants wished to use the trade-mark "Thermit."

Mr. Turner, who supported the application by evidence, explained that although anybody could sell the powder under another name, they were prevented by the patents from using it for the purpose of welding.

Mr. Farmer, for the opponents, declared that if the applicants did use the powder they would not get results approaching those of the Thermit Co. The welds would not be strong and permanent. Originally the Thermit Co. sold the powder, and allowed local people to do the work. This was not successful, and Corporations, in view of their experiences, now preferred to have the loan of one of the company's own men to do the work.

Replying to the Comptroller-General, Mr. Farmer said that the company did not make the employment of their own men a condition of sale. The Corporations preferred the company's men to do it. He added that the shareholders of the company had placed it under the control of a British director. All the profits were to be kept in the country, and what happened to them became one of the conditions of peace when peace was restored.

Mr. Colefax, K.C., said that under the proclamation a company registered in Great Britain was not an alien enemy, however it might be controlled. There had been no diminution of the Thermit Co.'s work since the war. The real strength of the position was that, while one could weld perfectly well under these patents, one could not weld unless he had the company's secret. The applicants could weld tramlines without infringing the patents, but they would not do the work to the satisfaction of any Corporation authority, even if they got a licence under the patents. In this case the one director had absolute power. No resident in Germany had any power to deprive him of his power, or had any power in the company during the war.

Mr. Schultz, the director in question, gave evidence, stating that he was naturalised in 1902, while his father had been naturalised as a British Indian subject. He bore out the statements of counsel as to the position of the company.

The hearing was closed.

St. John Ambulance Department.—An appeal is being made for funds by means of a one-shilling collection. The wonderful work done by the department—which has established 150 hospitals, sent over 200 doctors and nurses to the front, provided over 5,500 orderlies, and forwarded 748 cases of medical stores and supplies, including 56,000 articles of clothing—commands our admiration and should compel our support. Donations should be sent to the Department at Marconi House, Strand, London, W.C.

Dividend Reduced.—A short time before the outbreak of the war, the A.G. Brown-Boveri & Cie., of Baden (Switzerland), declared a dividend of 9 per cent. for the year 1913-14, but, in consideration of the later events, and a probable, or, at least, possible, reduction of activity, it has now been definitely decided to reduce the dividend to 5 per cent.

Institution and Lecture Notes.—Iron and Steel Institute.—In order to comply with the rules for dealing with purely formal business a statutory autumn meeting is to be held on Thursday, November 19th, at 11 a.m., at 28, Victoria Street, S.W. It will be remembered that the autumn meeting arranged for Paris could not be held, and the papers were taken as read.

A Research Prize of the value of £200 has been placed by Sir Robert A. Hadfield, F.R.S., Past President, at the disposal of the Council, to be awarded for original research work on the subject of the different forms or combinations of carbon in iron, steel, and alloys of iron with other elements. Intending competitors should communicate with Mr. G. C. Lloyd, secretary, 28, Victoria Street, London, S.W.

Nottingham Society of Engineers.—The first meeting of the session was held on November 4th. Mr. Wm. Yorath Lewis gave a lecture on the Niclausse Boiler. On November 18th, Mr. G. W. Worrall will give a paper on "Electrical Machinery."

North Staffs. Institute of Mining and Mechanical Engineers.—At the meeting held on October 26th at Stoke, the new president, Mr. J. Gregory, in the course of an address, stated that to-day, in spite of an enormous increase of depth and load, there were few instances where, in laying out a new colliery, a considerable advantage could not be obtained by the use of electricity. The length of time occupied in a single wind was so short that the utmost attention must be devoted to the periods of acceleration and deceleration, and it was here that the electric motor scored. A minor point, but one well worth considering, in the case of deep shafts, was the even turning moment of an electric motor, which contributed to the steady running of the winding rope.

With regard to the use of electricity for purposes other than winding, the extent to which this method of power transmission had already been applied was evident from the annual report of Mr. Johnstone, wherein it was stated that in North Staffordshire collieries alone, motors aggregating nearly 16,000 H.P. were in use at the end of the year 1913.

Mr. Hassam pointed out how very detrimental it was to that district that they had no large electric power supply to draw upon. If there were such a supply, quite a number of collieries and manufactories would electrify very much more than they did to-day. He was connected with a colliery development which would probably have been electrified throughout if there had been a large power supply to draw upon.

Institution of Electrical Engineers. — At the opening meeting of the 1914-15 session, which was held on the 29th ult., the distribution of the prizes, premiums, &c., awarded for papers read during the previous session (see Electrical Review, May 22nd, p. 862) took place.

Mr. Lewellyn Preece presented to the Institution a marble bust of Michael Faraday, on behalf of the family of the late Sir W. H. Preece. He referred to the desire expressed by his father on the last occasion on which he spoke in that hall, that the bust in question should find its way to the Institution, and mentioned their indebtedness to the sculptor, Mr. McDougal, and to Dr. S. P. Thompson, who had paid many visits of inspection to the studio, for the lifelike resemblance of the work.

Mr. W. Duddell—the retiring president—suitably acknowledged the gift on behalf of the Institution.

Subsequently, Sir John Snell—the president elect—having taken the chair, Dr. Thompson proposed a vote of thanks to Mr. Duddell for his efforts on behalf of the Institution during the two years in which he had filled the difficult office of president. He believed they had been very prosperous years, and during that time the membership had increased to over 7,000. Prof. Kapp, in seconding, pointed out that Mr. Duddell was a scientist and, at the same time, a practical man of business.

The president, Sir John Snell, then read his address, which we refer to elsewhere in our columns, and at the conclusion a reception by the president and Council was held in the common room of the Institution.

Association of Mining Electrical Engineers.—The opening meeting of the winter session of the Notts. and Derbyshire branch was held recently at Nottingham. Mr. L. G. F. Routledge was elected president, and Mr. F. Smith read a paper on "Repairs to Electrical Plant."

The subject of "Power Factor and its Improvement" was discussed by the Yorkshire Branch of the Association, at Leeds, on Saturday, being introduced in a paper by Mr. L. G. F. Routledge.

Rontgen Society.—On November 3rd Sir A. P. Gould, in the course of his Presidential address, remarked that most of the members of the Society were engaged in dealing with those wounded in the present war. When the war broke out the supply of tubes became restricted. An up-to-date equipment in radiography was necessary to every institution which dealt with the wounded. Of all the recent additions to the means of surgical diagnosis none was attended with such immediate benefit as radiography.

The Polytechnic Engineering Society.—The members of the Society paid a visit to the Ediswan Works on November 2nd, headed by their hon. secretary, Mr. R. Harben, when the various departments dealing with lamp and fitting manufacture were seen in active operation.

The Junior Institution of Engineers.—Mr. Robert Rankin, B.Sc., lectured recently on "The Working of Storage Batteries." Prevailing misunderstandings regarding the completion of the first charge were dealt with, and the necessity of continuing it until there was a complete cessation of increase in specific gravities and voltages, was emphasised. One fruitful source of trouble was excessive discharging, and Mr. Rankin described an instrument which he had invented to enable battery operators to keep within proper limits. Attention was drawn to the necessity, in the case of stationary batteries, of keeping proper log-sheets of the working, and of adhering intelligently to a proper set of working instructions, instead of religiously stopping the discharge at a definite voltage, and stopping the charge when the ampere-hours, put back after a discharge, reached a definite percentage over the latter, both voltage and ampere-hours being indicated by instruments which might be very inaccurate.

Greenock Electrical Society.—On October 29th, Mr. R. A. D. Macalister read a paper on "The Manufacture of Electric Cables."

Compensation in Russia for Damages to Trade.—The German-Russian Association is, according to a report from Berlin, co-operating with the German Foreign Office with a view to making preparations for the purpose of working out estimates of the losses that German firms and interests are likely to suffer in Russia in consequence of the war, and for which afterwards compensation will be demanded. All the firms that are interested in Russia are, therefore, recommended as soon as possible to communicate with the Association, and to give a detailed statement of their properties in Russia and their stocks of goods stored there privately at the Custom House or at the railway stores, and, further, to give a statement of their outstanding debts, and of how much they fear to lose. The Association will also assist the trade with the cashing of outstanding debts in Russia, and do all in its power with the view of securing the payment of same in the best way.

Business in Germany.—A circular, signed by a number of German electrical firms, was sent some time ago to customers, in which the latter were informed that the prices of electrical goods were to be raised in consequence of the war. The firm Dr. Paul Meyer, A.-G., of Berlin, which was one of the signatories, has now announced its withdrawal, and pointed out that it would attempt as long as possible to keep prices on the same level as they were before, and further promised to stick to the old terms for sale, and to keep the same terms of payment. It makes the reservation that its action is dependent very much on the position of the copper market and the price of copper, which, of course, may enforce a slight increase of the price for manufactures.

The War and Contracts.—The *Times* reports that the Streets Committee of the City Corporation have requested the Corporation forthwith to ask the Government to obtain power for the determination of contracts with companies for the supply of goods imported from any country with which this country is at war, or manufactured, or partly manufactured, in any such hostile country, and for the determination of contracts with companies which are, or were, on and subsequently to January 1st, 1914, under the management of, or a majority of whose directors or shareholders are or were, during that period, born subjects of any such hostile countries.

British Trade with the Straits Settlements.—Mr. A. Stuart, Registrar of Imports and Exports at Singapore, the Correspondent of the Board of Trade for the Straits Settlements, who is now on a visit to England, will attend at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C., on Tuesday, Wednesday and Thursday, November 17th, 18th and 19th, between the hours of 10 a.m. and 5 p.m., and will be pleased to see by appointment British manufacturers and traders not represented in the Straits Settlements, who may desire to consult him regarding trade conditions and openings in that Colony. Applications for appointments with Mr. Stuart should be made promptly to the Director of the Commercial Intelligence Branch, as above.

German Electrical Industry.—The *Kölnische Zeitung* of September 16th states that during August the German electrical trade was, in common with every other branch of industry, thrown into confusion by the interruption of traffic communications owing to mobilisation. On the resumption of rail traffic, the shortage of raw material continued to exert a depressing influence, and very few new orders were placed during the month of August. Subsequently some improvement was observable as far as home orders were concerned, but export trade appears to have remained entirely at a standstill. The A.E.G. has been able to keep some of its departments busy with war material, and has also undertaken work which, in normal times, would not have come within the scope of its activity.—*Board of Trade Journal.*

Inquiries.—The following are asked for:—Makers of glass wool and glass cells as applied to the small accumulator trades; makers of the "Atom" vacuum cleaner; makers of miniature hot-wire ammeters, reading to 0·5 ampere; makers of cheap paper-lined brass or zinc bell-wire tubing; makers of metal cylinders with coloured glass bull's-eyes, ⅜-in. diameter.

Appointments Vacant. — Two assistant engineers (£432), for Electrical Engineer's Office, P.M.G.'s Department, Melbourne; shift engineer (25s.), for Sevenoaks and District Electricity Co.; charge engineer (£115), for Swansea Corporation Electricity Department; junior engineers (25s.), for Cleveland and Durham Electric Power, Ltd.; junior assistant engineers for Newcastle-on-Tyne Electric Supply Co. (15s.); charge engineer (period of war), for Burton-upon-Trent Electricity Department (£2 5s.); switchboard assistant (25s.), for Stepney. Particulars are given in our advertisement pages.

Fatality.—A correspondent states that on Tuesday night George Lee, jointer, in the employ of the Eccles Corporation, was killed electrically at the Cawdor Street electricity works. He was 30 years of age.

Late Correspondence.—

BRITISH INDUSTRY AND THE WAR.

I observe a criticism in your journal with regard to the book, "British Industry and the War," sent to you for review, which, I think, has been written under a misapprehension.

The trade journal which the Institute propose to establish is a general trade journal, and not a specialised one such as your paper is well known to be. You will readily appreciate that it will be impossible for a general trade journal to cover the ground in your section as comprehensively as yourself. My remarks, therefore, were not intended to apply to your special journal, but to general trade journals, such as the Board of Trade and Chambers of Commerce, &c.

I am sorry it has been misunderstood, and I am having the particular part modified so as to make the point quite clear.

If it is necessary to have specialised trade organisations, it is as surely essential to have specialised trade journals, and you may rest assured that, as far as the Institute is concerned, it will do everything it possibly can to advance your interests, and in doing this we will be automatically advancing in the interests of specialised trades. In the circumstances the Institute will do everything it possibly can to increase the circulation and usefulness of your journal, and our services are always at your disposal for that purpose.

J. TAYLOR PEDDIE,
Chairman, Provisional Organising Committee.

London, W.C., *November 3rd*, 1914.

[It is comforting to have Mr. Taylor Peddie's assurance that he did not mean our humble selves when he called the "usual trade journals," "deadly in character." We never thought he did, or we should have taken no notice of the matter. But it must be very disconcerting for the *Board of Trade Journal* and the *London Chamber of Commerce Journal*—useful publications, from which we ourselves frequently find it necessary to quote—to be told that that particular remark was intended for them. With all due respect to Mr. Peddie, we venture to think that in his efforts to explain himself he does not improve the situation. No worthy attempt to assist British trade and industry is going to make rapid headway or receive proper support if its originators go needlessly out of their way to reflect upon what others are doing. However, the author is going to make his meaning quite clear—presumably in later editions of the book when they are required—and we are proud to know that both he and the Institute have it in their hearts to assist the ELECTRICAL REVIEW to increase both its circulation and its usefulness.—EDS. E.R.]

Shorthand Typists from Berlin.—Mr. Geo. de Curtis, of the P.O. Engineering Department, Kingsland Green, N.E., informs us that a number of English lady typists, until lately in the employ of a leading German electrical company in Berlin, have been obliged to return home owing to the strong feeling against all English people in that city, and are now seeking situations in this country. These ladies are exceptionally skilful and well versed in languages, and should prove very useful to British electrical firms. Communications addressed to Mr. Geo. de Curtis, care of this office, will be duly forwarded.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. R. LAWTON, of the Leigh Borough Accountants' department, has been appointed clerk and meter inspector in the electricity department.

Tramway Officials.—Councillor E. Heap, chairman of the Burnley Corporation Tramways Committee, informed the Town Council on October 29th that MR. MOZLEY, the tramways manager, was a true-born Englishman, having been born near Sheffield.

General.—The *Birmingham Daily Post* states that CORPORAL WILLIAM BUTT, of the Royal Engineers Telegraph Section, a native of Dorchester, has been presented by the French Government with the military medal of the Legion of Honour for distinguished service at the front. The presentation was made by Sir John French in the presence of his staff.

MR. ARTHUR CARL SCHOLZ, electrical engineer, of 442, Slade Road, Edgbaston, Birmingham, who is a British subject, born at Aston Manor, has by deed poll assumed the name of Arthur Charles.

MR. W. SCHMAHL, managing director of the Armorduct Manufacturing Co., Ltd., announces that in the interests of his wife and children, who are English by birth, he has altered his name to W. Ratcliffe-Small. Mr. Schmahl has been in this country since he was 20 years of age, has been naturalised for a number of years, all his ties and sympathies are in this country, and he has no desire or intention to transfer them to any other.

The marriage took place at All Saints' Church, Langton, Tunbridge Wells, on October 31st, of MR. PERCY G. HOBBS, of the Electrical Installation Co., Tunbridge Wells, and Miss Winifred Ida Hoptroff, of Langton. The bridegroom, who is serving with the 30th Company, Royal Engineers at Plymouth, was granted 48 hours' leave for the happy occasion, and was attended by his best man, Trooper D. Hoptroff, of the Royal West Kent Yeomanry. The presents included a tantalus from the staff of the Electrical Installation Co.

MR. J. J. EASTON has joined the board of directors of Siemens Brothers & Co., Ltd.

Obituary.—MR. STUART RICHARDSON.—We regret to learn that Mr. Stuart Richardson, city electrical engineer, of Wellington, New Zealand, was taken ill after attending a meeting of the Tramway Board on September 10th and passed away on the following day. Mr. Richardson was born at Swansea in 1863, and as a young man spent some years in Australia. On returning to England he entered the Brush Co.'s works at Loughborough, where he was trained as an electrical engineer. Afterwards he entered the service of the Corporation of Leicester and was appointed chief electrical engineer. In 1899 he went out to New Zealand as engineer and manager to the Electrical Syndicate which then controlled the electric lighting of the City of Wellington. On the termination of his engagement with the syndicate he entered the service of the Wellington Corporation, which was then installing the electric tramway system. In 1905 he was appointed tramways and electrical engineer to the Corporation, and this position he held until his death. Mr. Richardson, who was a member of the Institution of Electrical Engineers, was held in high esteem by those connected with the electrical and tramway industries, not only in Wellington, but throughout the Dominion.

MR. C. CLARKE.—The death is reported, after a brief illness, of Mr. Claud Clarke, superintendent for the Scottish Central Power Co. at Falkirk, at the age of 24 years. Deceased was trained at the St. Helens Corporation Electricity Works under Mr. E. M. Hollingsworth, and later studied at Glasgow University, where he passed his Inter. B.Sc. examination.

MR. A. D. BROADBENT.—We regret to state that Mr. A. D. Broadbent, of Perth, W.A., who, as reported in our last issue, was shot by some person unknown, succumbed to his injuries on September 20th, after enduring great pain for nine days. He leaves a widow and two children. He had been chief assistant to his brother (Mr. Herbert Broadbent, city electrical engineer) practically from the commencement of the undertaking, and his services were highly valued by the Corporation, which recently presented him with a handsome honorarium in recognition of his efficient conduct of the works during a visit of his chief to this country; he was also exceedingly popular with the staff.

NEW COMPANIES REGISTERED.

Implitico, Ltd. (138,160).—This company was registered on October 30th, with a capital of £3,000 in £1 shares, to carry on the business of electricians, mechanical engineers, manufacturers, workers of electricity, motive power and light, &c. The subscribers (with one share each) are:—W. R. Lambert, 28, Avington Grove, Penge, S.E., electrical engineer; H. S. Lambert, 203, Waller Road, New Cross, S.E. (electrical engineer). Private company. W. R. Lambert and H. S. Lambert are permanent governing directors; special qualification, £500. Registered office, 2-6, Pocock Street, Blackfriars, S.E.

Tyne Glass Works, Ltd. (138,170).—This company was registered on October 30th, with a capital of £2,000 in £1 shares (500 "A" and 1,500 "B"), to carry on the business of glass manufacturers, workers, blowers, cutters, engravers, embossers, riveters, silverers, stainers, stoppers, grinders, polishers, drillers and perforators, &c., and to carry into effect two contracts (*a*) with T. W. Ferry and (*b*) with Pope's Electric Lamp Co., Ltd. The subscribers are:—M. W. O'Connell, 18, Nicol Road, Harlesden, N.W., electric lamp manufacturer, one "B" share; T. W. Ferry, Inglewood, Low Fell, Co. Durham, glass manufacturer, one "A" share. Private company. The number of directors is not to be less than two or more than four; the first are M. W. O'Connell and T. W. Ferry (both permanent): qualification, £250. Registered office, 68, Pipewellgate, Gateshead-on-Tyne, Durham.

Allies Electric Lamp Co., Ltd. (138,125).—This company was registered on October 28th, with a capital of £3,000 in £1 shares, to carry on the business of manufacturers, importers, exporters, repairers and fitters of, and dealers in, electric lamps, glass blowers, manufacturers of, and dealers in, glass, wire, drawn wire, metallic filaments, wolfram, platinum and other metals, electricians, electrical and mechanical engineers, suppliers of electrical energy, &c. The subscribers (with one share each) are:—J. E. Bithry, 18, Cromwell Avenue, Highgate, N., shipping agent; R. W. Latimer, 18, Caxton Road, Shepherd's Bush, W., electrician. Private Company. The number of directors is not to be less than two or more than five; the first are not named. Solicitor engaged in formation of company, L. G. Crauford, 69, Chancery Lane, W.C.

High Speed Steel Alloys, Ltd. (138,130).—This company was registered on October 28th with a capital of £50,000 in £1 shares, to carry on the business of manufacturers of and dealers in tungsten, molybdenum, vanadium, chrome and any other metals or substances used in connection with the manufacture of steel, general merchants, miners, ironmasters, smelters, engineers, manufacturers of chemicals, ironfounders, &c. The subscribers (with one share each) are:—A. Balfour, Dannemora Steel Works, Sheffield, steel manufacturer; A. J. Hobson, Suffolk Works, Sheffield, steel manufacturer. Private company. The number of directors is not to be less than four or more than seven: the first are A. Balfour, A. J. Hobson, F. Best, Norfolk Works, Sheffield; H. H. Smith-Carrington, Openshaw, near Manchester; W. Clark, River Don Works, Sheffield; and O. W. Fawcett, Clyde Steel Works, Sheffield; qualification, £200; remuneration, £100 each per annum, and an additional £20 for each 1 per cent. dividend in excess of 5 per cent. Registered office, 13, East Parade, Sheffield.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

St. Helen's Cable and Rubber Co., Ltd.—Sub-mortgage, as collateral security, dated October 1st, 1914, to secure £15,884 owing to the company, and land, building, hereditaments and premises at Warrington, and machinery, &c., therein, subject to redemption under mortgage dated September 30th. Holder: Sir Joseph Beecham, Bart., St. Helens.

Reason Manufacturing Co., Ltd.—A memorandum of deposit in full, on September 28th, 1914, of debs., dated October 1st, 1906, securing £12,500, has been filed.

Spensers, Ltd.—Issue on October 13th, 1914, of £400 debs., part of a series of which particulars have already been filed.

Cutting Brothers, Ltd.—Issue on October 10th, 1914, of £200 debs., part of a series of which particulars have already been filed.

Aberdare Electrical Co., Ltd.—Particulars of £500 debentures, created October 13th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Topsham Electricity Supply Co., Ltd.—Issue on October 15th, 1914, of £300 debentures, part of a series of which particulars have already been filed.

Chipping Norton Electric Supply Co., Ltd.—Particulars of £4,000 debs., created October 20th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Carmarthen Electric Supply Co., Ltd.—A memorandum of satisfaction in full on April 14th, 1914, of debs. (*a*) dated March 30th, 1911, securing £650, and (*b*) dated February 22nd, 1911, and March 25th, 1914, securing £2,350, has been filed.

CITY NOTES.

Vera Cruz Electric Light, Power and Traction, Ltd.

THE directors' report for the year ended December 31st, 1913, shows that the net profits in Mexico for the year 1913 amount to $378,304 (Mex.), with an increase of $66,934. Reckoning the earnings at the parity of exchange there is a balance, after meeting all expenses and debenture interest, of £23,985, but owing to the heavy loss in exchange, which amounted to £10,497, the available balance of profit is reduced to £13,488 plus £4,509 brought forward. Deducting the transfer to depreciation and general reserve account, £5,000, there is a balance of £12,997, which, owing to the disturbed state of Mexico and the uncertain state of exchange is to be carried forward. Notwithstanding the political disturbances in Mexico, the property of the company has suffered little damage. The supply of power from the Puebla Tramway, Light and Power Co. is not yet available owing to these disturbances, but it is hoped that the transmission line to Vera Cruz will be completed shortly. An extension of the tramway system is under construction and should be completed in the next few months.

The seventh annual meeting was fixed to take place on October 28th, at Salisbury House, E.C. At the time fixed for holding the meeting there were no shareholders present, and the secretary announced to the Press that no meeting would be held. In reply to a question as to whether the directors would not be present, the secretary said they formed a quorum and would hold a meeting in another room. He proceeded to collect his books and left the room, and before our reporter had written half this paragraph he returned and announced that the report had been adopted and the retiring directors and auditors re-elected.

Ferranti, Ltd.

MR. A. W. TAIT presided on October 30th at the annual meeting, held at the offices, Central House, Kingsway.

In proposing the adoption of the report (ELEC. REV., p. 568) the CHAIRMAN said that the trading profit for the year was £47,257, as compared with £59,599 for the previous year, or a decrease of £12,343. The decrease was due in a considerable measure to the discontinuance of large switch-gear work and the building up of new business in switch-gear details. It was hardly possible to expect that so large a change in one of the principal departments of the company's business could be effected without a certain amount of dislocation and falling off in one class of orders before the necessary orders in substitution could be obtained to an adequate degree. He was pleased to say, however, that considerable advance had been made during the year in completing the company's designs in certain lines of detail switch-gear, power transformers, etc., and had it not been for the unfortunate conditions created by the war it would have been reasonable to expect that the trading for the current year would have considerably benefited thereby. Another matter which contributed to the decrease was the falling off in export business due to monetary conditions in certain countries. That applied more particularly to Canada, where for some years past the company had carried on an increasingly profitable business; but, as they were aware, the monetary conditions in that country for some considerable time past had been unsatisfactory, and, owing to the restriction of credit, there had been a necessary restriction of business. They regarded that as a more or less temporary stoppage in the development of a country in which there was bound to be in the future a very large call for the articles which the company manufactured. General establishment charges showed a decrease of £2,551 as compared with the previous year. Since the close of the year certain economies had been effected, and it was reasonable to expect some further decrease in that figure during the current twelve months. Repairs and renewals amounted to £4,680, a decrease of £2,060. The net result for the year, before charging interest, was a balance of £19,776 against £28,143, or a decrease of £8,367. The interest charges amounted to £8,178, approximately the same as last year, and they had, as usual, placed £10,000 to depreciation reserve, leaving a balance of £1,598, which, together with £452, the balance at credit at 30th June, 1913, made a total of £2,050 to carry forward. Proceeding to deal with the balance sheet, the Chairman said that the item of plant, machinery, tools and fixtures at £125,966 showed an increase of £5,131 over the previous year. Expenditure on work in hand at £65,662 showed a decrease of £11,455. A certain amount of that decrease was to be accounted for by the falling off of business in certain lines, but more particularly by the supervision which had been exercised in the matter of stock of meters and stock parts. Stocks and stores on hand, £21,921, was approximately the same figure as last year. Sundry debtors, after making reserve for bad and doubtful debts, stood at £59,763, a decrease of £6,333. Goodwill and patent rights remained at the fixed figure of £69,546. On the liability side, first mortgage debenture stock at £90,000 showed a decrease of £6,000, due to the application of the sinking fund. Sundry creditors stood at £37,881, which was a substantial decrease of £13,356 as compared with the previous year. The depreciation reserve account, with the £10,000 added this year, now stood at £66,350. If they added the £22,000 in the general reserve they had a total of £88,350, which was a substantial figure as against the depreciation in leasehold land, buildings, plant and machinery, and for writing down the item of goodwill. As he stated at the last meeting, it was not intended to deal with the application of these reserves until 1917, when the whole position of the capital account would have to be revised. With regard to business generally, it would, of course, be idle for him to make any forecast as to the prospects of the business for the current year, but had it not been for the conditions created by the war he believed they could have looked forward for a substantial increase in business, with the probability of a repetition of the results for the year 1913, which were the best in the history of the company since its re-organisation. They must, however, look at the position as it existed now, with the prospect that, no matter for what length of time the present disastrous war might continue, financial and business affairs would be seriously affected for some considerable time to come. The directors, aided by the managers of the various departments, had instituted considerable economies which had not in any way affected the efficiency of the business, but which would enable it to meet the decrease of business during the period of depression. He was pleased to say, however, that the falling off in orders received was not so large as might be expected, and, in fact, over the last few weeks the prospects showed considerable improvement, and he believed that improvement would continue and increase if the parties at the head of international financial affairs could quickly bring about some re-establishment of international exchange. That had been, and was still, one of the most serious difficulties with which manufacturers had had to contend in carrying on business with the British Colonies and with other countries during the last few weeks. The company's works were now up to a high standard of efficiency as regarded plant, not only to cope with the existing volume of turnover, but also to deal with a substantial increase when the same arose, and there was every reason to hope that when conditions returned more or less to the normal, the development which had been progressive for some years past would re-assert itself. He could not conclude without referring to the very great loss which the company had suffered through the death of Mr. A. Bruce Anderson, the managing director, who was drowned in the sinking of the *Empress of Ireland* last May. Mr. Anderson had been on a visit to Canada in connection with the company's affairs there, as had been his custom for some years past, and by an unhappy fate he sailed by the *Empress of Ireland*, although it had been his previous custom always to return *via* New York. Mr. Anderson had been connected with the company for a very long time, practically being associated with it from the commencement. He had a thorough and intimate grasp of its affairs, having grown up with the business, and the satisfactory progressive results which had been shown ever since the re-organisation of the company were very largely due to the ability and knowledge which he exhibited in the conduct of its affairs as managing director. As he was cut down in the prime of life, and while in the midst of establishing his position in the commercial world, it was hardly to be expected that he had been able to make any substantial provision for his widow and children. The directors, therefore, felt that it was incumbent upon them to make some provision for his widow, and they had, therefore, granted to Mrs. Anderson a pension of £200 a year and £100 to each of his three children until they respectively reached the age of 18 years, at the end of which time the whole pension expired. He thought that was the least the company could do as some small measure of recompense for the life work of Mr. Anderson in connection with the affairs of the company. No steps had yet been taken to appoint anyone to fill the vacancy caused by Mr. Anderson's death, although the matter had had the careful attention of the directors. He was pleased to say that the managers of the various departments, together with the Secretary, Mr. Morris, had ably assisted the board in carrying on the company's affairs, and he desired to record the directors' appreciation of this assistance during a trying period.

Mr. ARTHUR WHITTAKER seconded the motion, which was adopted without discussion.

North Metropolitan Electric Power Supply Co.—The *Financial Times* states that a special general meeting of the holders of the preference stock is to be held on 11th inst. to consider a resolution authorising the company to convert the existing £300,000 of preference stock into fully-paid 6 per cent. cumulative £1 preference shares.

Reduction of Capital.—NATIONAL ELECTRIC CONSTRUCTION CO., LTD. (AND RED.).—A petition for confirming the reduction of the capital from £250,000 to £125,000 is to be heard on November 13th.

West African Telegraph Co., Ltd.—Interim dividend at the rate of 4 per cent. per annum, free of income-tax, for the past half-year.

Brisbane Electric Tramways Investment Co., Ltd.—Interim dividend at the rate of 8 per cent. per annum, free of income-tax, on the ordinary shares for the past half-year.

United Electric Tramways Co. of Caracas, Ltd.—The directors announce that during the period of the present war they consider it desirable that profits should, so far as the other interests of the company permit, be fully divided among the shareholders. They therefore requested the local company to declare a dividend which would absorb the whole of their net profits for the past 12 months. The net revenue to June 30th shows a disposable balance £19,906. A dividend for year of 7 per cent. and a bonus of 4 per cent. (less tax) are to be paid, absorbing £18,700, leaving £1,206 to be carried forward. The profits of the local company again show a gratifying increase. The net receipts were £31,761, an increase of £5,322.

Lima Light, Power and Tramways Co.—A general meeting of holders of first mortgage debentures will be held on November 18th, for the purpose of passing an extraordinary resolution assenting to the postponement of the redemption of debentures until the expiration of one year after peace has been declared by all the powers involved in the present European war. No dividends are to be paid until after these payments shall have been renewed.—*Financial Times.*

Western Telegraph Co., Ltd.—The directors report that for the year ended June 30th, 1914, the revenue amounted to £902,837 and the working expenses to £389,943. After providing £32,747 for debenture stock interest, and £18,447 for income-tax, there remains £461,700 plus £37,008 brought forward, making a total of £498,708. Three interim dividends, amounting to £93,568 have been paid, £160,000 transferred to the general reserve fund, £30,000 to the land and buildings depreciation fund, and £130,000 to the provision on account of investment fluctuations. The directors now recommend the declaration of a final dividend of 3s. per share, making, with the interim dividends, a total dividend of 6 per-cent. for the year, also the payment of a bonus of 2s. per share, both free of income-tax, which together will amount to £51,982, leaving £33,157 to be carried forward. The dividend and bonus will be payable on November 12th.

Buenos Ayres Tramways Co. (1904), Ltd.—The directors have declared a dividend of 1s. 3d. per share (5 per cent. per annum), less income-tax, for the three months ended September 30th, payable November 17th.

Metropolitan Electric Supply Co., Ltd.—The directors have declared payment of the postponed interim dividend for the half-year to June 30th last, at the rate of 4 per cent. per annum.

Craigpark Electric Cable Co., Ltd.—Interim dividend on the 6 per cent. preference shares, less tax, is payable on November 11th.

Germany.—THE ELEKTRA A.G. OF DRESDEN.—According to the balance-sheet of this company for 1913-14, which has been published recently, the profits for the year amounted to £18,900, or practically the same amount as in 1912-13. At the general meeting was declared a dividend of 6 per cent. The capital of the company is £225,000, in addition to which it has also a loan of £112,500.

STOCKS AND SHARES.

Tuesday Evening.

THE scheme formulated by the Government, whereby loans from bankers to London Stock Exchange members shall, for practical purposes, be suspended until a year after conclusion of peace, met with cordial welcome at the hands of members. Some of them went so far as to say that the Government plan would have the effect of saving at least 75 per cent. of members from failure—or liquidation, as the official word now is. The simplicity of the scheme is striking, and it must needs be followed by amplification of details, with extension of its principles, by new rules from the Stock Exchange. These may be published before this is; but, in the interval of waiting, business is tame.

One result of the Government scheme has been to revive anticipation of early re-opening of the House. Some members think that business will be started up officially on November 18th, when another settlement falls due to be arranged, but the pessimists put a later date upon the re-opening, and they are much more likely to prove right. The Treasury now controls the time when the Stock Exchange shall officially start business again, and this means, in other words, that for the time being the House becomes nationalised!

That there must be a host of new issues forthcoming, and that before long, is regarded as a certainty, unless the Government steps in and intimates plainly that other borrowers, who do not require money for war purposes, will not be considered as honoured guests in the financial fields just now. Promoters are well enough aware of this, and, besides, there is the difficulty of getting underwriters to take up lines of new stock at the present time. Were this not so, certain new issues would be forthcoming within the next few days; but borrowers are obliged to curb their desires to vanishing point.

The London County Council has this week published long report[8] upon its scheme, which comes before it on November 10th, for the linking-up of the electrical interests of the metropolis. Under the present proposals an issue of about five million pounds sterling would be involved, spread over a period of five years, and, as we were saying last week, this may prove to be the rock upon which the Bill will suffer possible shipwreck, because of the Government's wish to borrow as much as possible of the floating supply of capital now on hand.

We have been asked to give a table of the yields obtainable from Telegraph stocks and shares, in view of the flourishing business which the companies are doing, and the fact that the current year has witnessed heavy falls in most of the leading varieties. Figures something similar to the annexed have been published from time to time, but this table rounds off the information to date. In one or two cases it is more easy to sell than it is to buy stock:—

Stock or share.	Price.	Dividend.	Yield.
Anglo-American Preferred	101	6 %	£5 18 10
Eastern Extension	11⅝	7 %	6 0 2
Eastern Telegraph Ordinary	125½	7 %	5 11 7
Globe Ordinary	10½	6 %	5 14 3
Globe Preference	12½	6 %	4 16 0
Western Telegraph	12⅝	7 %	5 11 0
Cuba Submarine	8½	6 %	7 1 2
Direct United States	6¼	4 %	6 8 0

The River Plate Electricity Supply Company should have had no difficulty in getting its new capital subscribed, because, before the lists closed on November 5th, there was already a small premium on both classes of stock. Jobbers were bidding $\frac{1}{32}$ premium per cent. for each kind—Preference and Ordinary. The latter ought, of course, to stand very substantially higher, and is likely to do so as soon as the issue settles down into permanent hands.

The Lima Light, Power and Tramways Company will hold a meeting on November 18th, in order to submit a resolution to the First Mortgage Debenture holders, postponing redemption of the Debentures until the expiration of one year after peace is declared by all the Powers involved in the present European war. The immediate result would be to suspend the payment, which would be required for sinking fund purchases. The resolution further provides that no dividend shall be paid by the Company until the sinking fund payments shall have been renewed. The directors state that the necessity for doing this has been brought about entirely by the European war.

Brazil Tractions have been fluctuating between 49 and 46½, being now about 48½. Adelaide Electric Supply Debenture stock has hardened to 102¾. Calgary Power 5 per cent. Bonds were done the other day at 85¼. Winnipeg Debenture is offered at 91½, free of stamp duty. There are a few Philadelphia Company Bonds changing hands. The inquiry for Anglo-Argentine Tramways 4 per cent. Debenture is still noticeable, the price keeping very hard at 85; and the 5 per cent. Debenture stock remains in the neighbourhood of 88½.

London Electric Supply shares are exceedingly quiet, pending the developments in connection with the L.C.C. proposals already mentioned. London Debenture stock has been wanted at 89, and several other Debenture stocks can be placed with ease. This week's order with reference to the lights of London, while insisting upon the powers of the Admiralty and Police, have been read by some people as a gentle hint that slight relaxation of the stringency may be permitted. Possibly this is to bring the official attitude into line with that adopted by certain districts round London, where shopkeepers, in particular, have treated the instructions with indulgence. London United Tramway Debenture stock is called 60-65, but it is problematical whether dealings could take place on that basis.

The Manufacturing division keeps steady. Edison & Swan partly-paid at 5s. and the fully-paid at 1⅛, are firm. Westinghouse Preference keeps at 30s. Crompton Ordinary and Preference are 5s. and 10s. respectively. Small amounts of British Electric 5 per cent. Debenture stock have been done on the basis of 87½. The rubber market is quiet and uninteresting, but there may be significance in the fact that buying orders for shares reached Stock Exchange brokers early this week from large firms in Amsterdam closely connected with the raw rubber industry. The armament group is moderately active, with prices moving on a very narrow plane.

U.S.A. SAFETY RULES FOR THE OPERATION OF ELECTRICAL EQUIPMENT AND LINES.*

(*Concluded from page* 581.)

The general rules for the employé comprise general precautions in operation, in handling live equipment and lines, the "killing" or making dead of equipment and lines and moving parts, and making protective "grounds." The employé must be prepared at any time to show his knowledge of the rules; he is enjoined to be cautious, to keep away from danger, to warn others of danger, to treat everything as live unless positively known to be dead. Many of the requirements are very excellent, but are nothing more than such as would be naturally observed by a man who knows his job, and according to a previous rule already referred to, only competent men may be employed. Some of the requirements, however, seem to assume that the employé is either not qualified for the work or is not in that "competent mental and physical condition" previously specified. Thus "no employé shall touch two parts of different potentials at the same time" is an injunction which ought to be superfluous. If the employé is competent to know that the two parts are at different potentials, the requirement suggests a prohibition against suicide rather than a precaution against accident. Again, "accidental contacts with live parts should be carefully avoided," and "slipping or stumbling or moving backwards should be carefully avoided," beg the whole question, the actions referred to being essentially in the nature of accident.

That it should be thought necessary to include such clauses in the rules shows the weakness of attempting to ensure safety by mere personal instructions without first providing for the protection or screening of the apparatus and conductors. Thus, the rule dealing with handling of live equipment and lines at extra high potential requires that "no employé shall come or bring any conducting object within the distances named below, from any exposed ungrounded live part at or above the voltages specified:—

Voltage.	Distance (feet).
7,500	2
27,000	3
47,000	4
70,000	6

No wonder that the employé who is permitted to work within easy reach of exposed conductors at 20,000 volts is enjoined not to slip or to stumble or to make accidental contact with the conductors! Under the Factory Act Regulations in this country all conductors are required to be safe by position, *i.e.*, out of reach, or they must be protected, and even in the case of high-tension switchboards all conductors within reach must be protected.

A useful rule refers to verbal messages, and requires the receiver to repeat the message to the sender and to secure his acknowledgment. Serious accidents have occurred in this country through the misunderstanding of messages. If the message is telephonic there is no difficulty or delay in the repeating of it. If transmitted by messenger to a distance there may be much delay in the repetition and acknowledgment, the ground having to be traversed three times, but messages sent to a distance could generally be in writing.

There are numerous other general rules covering such matters as reporting clear when lines have been made dead, as to attachment and removal of "men-at-work" tags, making grounds, operating switchgear, etc. Employés are instructed not to place dependence for their safety on the insulating covering of wires, not to work from above on live parts when work can be done from below, not to operate isolating switches unless the circuit has been interrupted elsewhere, not to open secondary circuits of current transformers, etc.

The third section of the rules, comprising the special rules for employés, deals with the operation of power stations, switchboards, overhead lines, arc lamps, underground apparatus, meters, testing, signal lines and sub-ways. These rules are again numerous, and though for the most part they are quite sound, the bulk of them are of a most elementary character and suitable for the instruction of persons quite ignorant of or new to the work, and are of little general interest, as, for instance, the following from the Power Station section:—

Do not allow oil cans, tools and wiping cloths to catch in moving parts of machinery.

Do not work on or near exposed live parts unless authorised to do so.

In handling fuses or switches, use only the insulating handles or the special rods or tongs provided.

When working in an elevated position, keep tools and materials not in use in proper receptacles, and do not drop tools or materials.

Several of the requirements are repeated in the other sections.

Some of the dangers would again be more satisfactorily met by regulations for protection of the apparatus. Thus, in regard to switchboard operation, "When working near fuses and circuit-breakers, be careful to avoid injury from their operation. If the hands are exposed to flashes, wear insulating gloves." The use of gloves in ordinary operation ought to be unnecessary. It is difficult to see how care on the part of the operator can safeguard him from injury from an unprotected fuse should he happen to be close to it when it blows. A useful rule referring to the protection of other workmen is as follows: "Do not report lines or equipment dead for other men to work on until the lines or equipment have been cut out by air-break manual cut-outs, protective grounds have been applied to the parts so cut off, and 'men-at-work' tags have been attached to the cut-outs." The rules dealing with overhead lines require, amongst other things, that the worker before climbing shall see that the poles, ladders, cross-arms, etc., are strong enough to safely sustain his weight and that of the work to be done: that all lines (unless thoroughly grounded) which are being strung near power lines shall be treated as live: that when touching power lines the worker shall avoid touching guy wires, span wires, etc. Arc lamp trimmers must not handle any arc lamp until it has been disconnected from its circuit by an absolute cut-out. Dangerous conditions, such as sagging wires, broken insulators, must be reported.

In underground operation, workers before opening manholes where traffic may be obstructed must have the fire department notified! Manholes must not be entered until it is certain that they are free from dangerous gases. The openings must be surrounded by a barrier and danger signals exhibited, and a man must be stationed at the surface. Cables operating above 750 volts must not be spliced whilst live.

Meter setters must not leave joints or loose ends of wires untaped. Secondary circuits of current transformers must not be opened, but short-circuited before changing connections. Bare fingers must not be used to ascertain if the circuit is alive. Circuits must not be opened at meter connections.

In testing operations, the tester must thoroughly familiarise himself with all conditions surrounding equipment or lines to be touched, before making any change in these conditions, and must not make any change unless he fully understands the effect of the change. No persons shall work unaccompanied in testing or experimental work when the voltage exceeds 750 volts.

* U.S.A. Department of Commerce. Circular of the Bureau of Standards, No. 49.

The rules dealing with signal wires are similar to those for other overhead lines. Signal wires "in trouble" may be in contact with power wires at some other point, and should therefore be treated as live power wires. When stringing wires or cables over or under power lines, the lines being handled shall be treated as alive.

Tunnel and subway operation is dealt with separately from "underground operation" already referred to. Before handling any electric wires or equipment the worker should make sure whether they are alive or not. It is not advisable to work on live wires or equipment when the current can be safely shut off. It is dangerous to fool with live wires. The insulation on a wire may look perfect, but cannot be relied upon to prevent shock. Trailing cables must be inspected at least once daily. In handling portable motors or lamps it must be first ascertained that the external metal parts are not alive. This last requirement is no safeguard at all. Portable motors (*e.g.*, drills) or lamps may appear to be quite sound when first switched on, but may become electrically charged whilst in use, due to vibration or movement causing the connections or coils within to make contact with the metal work. It is much safer that they should be earthed as is required by the Mines and Factory Regulations in this country.

The foregoing extracts are sufficient to show the nature of the rules proposed. As already pointed out, many of them are made in view of dangerous conditions which need not be permitted to exist, and which would not be tolerated in this country. The rules dealing with overhead lines indicate very clearly the risks to which workmen are liable to be subjected to. Thus, the stringing of wires or cables over or near live power wires must be a very hazardous operation, even if they are treated as live and as of the same potential as the power lines, as required by the rules. In this country, so far as the writer is aware, none of the power companies having overhead lines would allow such work to be carried out with the power wires live. The overhead wire problem in this country is, however, not of such magnitude as in the States, and it is possible that the precaution of making power lines dead before work is carried out in close proximity, may there present greater difficulties. In cases where two or more sets of power wires are carried on the same poles, the dangers would be increased, and the difficulties of shutting down with consequent interruption of the supply would be still greater.

It is not suggested that the rules should be adopted in precisely the same form for all undertakings; some would be inapplicable, and possibly others would be required in certain cases. Several of the larger companies have already codes of rules of their own. The uniform adoption of a standard code so far as possible by the different concerns will no doubt prove to be an advantage, particularly in the event of employés going from one undertaking to another.

In this country several of the larger undertakings have excellent codes of rules for the use of their employés. They are printed in convenient form for carrying in the pocket so as to be always available for reference. Other undertakings and private works are generally content with notices posted in certain places, *e.g.*, at switchboards or in substations, giving particular instructions in regard to the operation of certain sections of the plant. Such posted notices, even if once read by the employés concerned, are apt to be forgotten. The method of providing a printed booklet of instructions to be always carried by the employé is certainly better, as the rules are more likely to be studied and remembered. In many cases, however, few, if any, printed instructions are even posted, it being left to the employés subject to any verbal instructions they may have received, to use their own judgment in all matters of operation. It would no doubt be of great service if printed operating rules in convenient form for the pocket were more generally adopted. The advantage of having such rules standardised so far as possible is also evident. This, of course, would require co-operation amongst engineers of electric supply undertakings and others. There is no lack of good material to draw upon. Some of the booklets issued by the larger power companies contain excellent rules, and better adapted for conditions obtaining in this country than those of the Bureau of Standards, though these latter should prove of material use in the compilation of such a code.

THE PRACTICAL TRAINING OF ENGINEERS.

In our last issue we referred to the recently issued report of the Special Committee of the Institution of Civil Engineers on the inquiry which was remitted to it by the Council in 1912, touching the practical training of engineers. We touched upon the previous enquiries and conferences which have been held at the instance of the Institution, and explained that the Special Committee, whose report has just been issued, was appointed as a result of the recommendations of the conference on the Education and Training of Engineers held in June, 1911.

It is owing to the complex nature of the subject, the extensive inquiries involved in its investigation, and other circumstances, that the inquiry has extended over such a considerable period of time.

Perhaps we may repeat that the Committee was appointed to consider the possibility of defining more clearly the conditions of the practical training in the various branches of the engineering profession, required by the bye-laws; also to consider whether anything could be done to establish some co-ordination between engineering colleges and engineers and other employers, so that the practical training of well-educated students might be facilitated.

As is now generally recognised, it is no longer necessary for a skilled engineer to be a skilled mechanic or artizan; nor, indeed, if this were still an essential requirement would there be any need for him to spend five or seven years in a works in order to become proficient in the use of tools. The incipient engineer of to-day, even if he intends to devote himself solely to manufacturing, can very soon, if of average intelligence, learn all there is to be learnt about the handicraft part of the subject. The uses and advantages of machine tools and the means of securing the maximum output from them; the composition and characteristics of metals; economy in the use of materials; these and many other things appertaining to design and management must form a part of his practical training. Practical design he can learn in the drawing office, but it is essential that he have a prior knowledge of theoretical design, the strength of materials, the elements of mechanism and so on, which knowledge is best acquired either at a technical college or by following courses of correspondence tuition. During his workshop training many points will arise upon which, assuming he has had a previous technical training, he can bring his theoretical knowledge to bear; he will know the uses of various parts of machines or mechanism on which he may be working; and why they are made in a particular way. He will appreciate the importance of precision in measurement and working, and the need for care in the handling of certain materials or parts, particularly those which may subsequently be subjected to electrical pressure. In all these matters, the youth who has been scientifically trained before entering

the works has an initial advantage over one who starts in the works without any technical or scientific training at all.

There is another side to this question, namely, that a scientifically trained youth cannot start his workshop career at so early an age as one who goes direct from school to workshop, and is therefore less inclined to start at the beginning, and may resent spending much time on the uninteresting part of the work. There is also the question as to whether or not a certain time, say twelve months, spent in the works as a preliminary to scientific training may give increased zest to study and give the practically trained student an advantage over one who is learning the technicalities of things of which he has no practical knowledge.

From these considerations there would appear to be much to be said in favour of the so-called "sandwich" system, one of the chief obstacles to which is the inconvenient arrangement of college terms. If the college session occupied the six winter months, the workshop experience could be taken during the six summer months, an arrangement which, from the point of view of the student, has many advantages. From the manufacturer's point of view this system is not so convenient or desirable, because if he has many apprentices the discontinuity of employment must cause a certain amount of disorganisation in his works; yet, as a member of the Institution of Civil Engineers, he may consider such a system a very good one for training engineering recruits.

It has also to be considered that our technical college courses do not adapt themselves very well to the sandwich system, and considerable modification would be necessary in order to permit of the fullest advantage being taken of it. It is clear, therefore, that two things are essential if the sandwich system is to become the recognised form of engineering training, viz.: (1) that employers should make some sacrifice for the benefit of the future generation of engineers and not look upon a pupil or apprentice as merely a dividend-earning unit, and (2) that the authorities of technical colleges and universities must colloborate with employers in order that the training should form an integral part of the complete engineering training.

The inquiry conducted by the Civil Engineers' Committee aimed at eliciting information on the foregoing considerations, and its first step was to approach a large number of engineers of various classes by letter, in which nine questions were propounded. As the questions are somewhat lengthy we give the essence of them as follows:—

1. Do you take into your works pupils or apprentices? Are they indentured? Do they pay a premium? What is the usual period of engagement?

2. Have the pupils or apprentices opportunities of gaining experience in various principal departments, and in the drawing office? and what period is allocated to each department?

3. Is a certificate issued stating or implying that the pupil has been afforded opportunities of acquiring suitable practical engineering knowledge?

4. Are facilities given for attending day classes in engineering subjects?

5. Are you disposed to take youths straight from school for a year's workshop training before they go into a university engineering school or become articled to an engineer?

6. Where no actual apprenticeship under indentures is served, would you give a definite undertaking that the pupil or apprentice—subject to conditions—should be afforded opportunities for acquiring the requisite knowledge to comply with the requirements for admission into the Institution?

Referring particularly to young men who have obtained a degree or diploma, exempting them from the Associate Membership examination, or are following a college course leading thereto, it was asked:—

7. If special facilities or advantages were given for practical training, considering that such pupils may be expected to make themselves useful after no great length of time.

8. If employers would make prospective arrangements with students before the completion of a college course, in order to avoid loss of time.

9. If employers would be willing to admit into their works or office for a part of each year engineering students pursuing a regular course of college study. This, of course, bears upon the sandwich system.

The replies to the foregoing questions are summarised in tabular form in the report, but the variety is such that it is difficult to generalise from them.

As regards the question of apprenticeship, 75 per cent. of the employers who replied to the questions make a practice of taking pupils or apprentices, and, of these, 75 per cent. require a premium with them. Out of the total number of pupils or apprentices accepted, about 70 per cent. are indentured, the remainder being unbound by any legal agreement. There is no uniformity in the period of practical or professional training, this ranging from two to five years, depending to some extent upon the previous technical training received. Practically all pupils and engineering apprentices are afforded opportunities of experience in the various principal departments, both as regards constructional and drawing office work. As regards drawing office experience, the time occupied varies from three months to half the total period of apprenticeship. In 86 per cent. of cases the employer gives a certificate of pupilage or apprenticeship.

As regards facilities for attending day classes, facilities are afforded in 54 per cent. of the cases to those pupils or apprentices who have not gone through a regular college course. Many employers insist on apprentices attending evening classes, and in such cases only those who have gone through a college course are accepted as pupils.

As regards the suggestion of affording a one year's preliminary workshop training prior to the college course, about 55 per cent. of the manufacturing engineers and engineers of public undertakings who have workshops are favourably disposed towards this system, but it does not appear to have been adopted in many cases, and, except as a special favour, this privilege would only be granted to those pupils who undertook to go back after the college course and complete their practical training.

In the case of unindentured pupils, about 58 per cent. are favourable to giving a statement, should it be desired by the Institution, that opportunities will be afforded of acquiring the practical knowledge required by the bye-laws, but many are disinclined to undertake any particular responsibility towards young men who enter their service without some corresponding *quid pro quo*.

As regards willingness to give special attention to young men who have completed a regular college course of study, about 46 per cent. of the correspondents expressed their willingness to do this, but a number of engineering firms are unconvinced that this preliminary training entitles the student to any particular consideration. The views held by many important manufacturing firms are to the effect that there is a scarcity of suitable students, and only a few have been found likely to be of service eventually; that the results generally have not been encouraging; that a purely scientifically educated student is absolutely of no use except on a very few jobs of design when his ability to calculate is useful; but, from the dividend-earning point of view he is practically useless. As a rule the expectations of early usefulness are rarely realised, and generally speaking youths who have obtained an engineering degree or have passed through an engineering course think too much of themselves, and

expect to get to the top of the tree before they have reached even the first branches.

On the question of making provisional arrangements with students for affording them practical training subsequent to the completion of their college courses, about 75 per cent. of the employers expressed their willingness to consider such an arrangement, provided the undertaking was by no means binding upon them.

As regards the sandwich system, about 53 per cent. of the whole of the employers who replied are favourably disposed to the method, whilst the remainder are opposed to it, and it is a notable feature of the replies that those least favourable towards it are engineers in private practice and engineers of railway and dock undertakings, whereas the most favourable are engineers of municipal undertakings and manufacturing firms.

One of the results of the inquiry is to show that considerable uncertainty prevails as to practical training with regard to the methods which should be adopted, but there is a disposition among employers to consider any proposal which may be brought forward with a view to improving and defining more clearly the conditions which should be observed; and considerable interest is also evinced in the matter of improving the co-ordination of scientific study and practical work.

Following, and as the result of, the replies received by the Committee, certain general conclusions were arrived at, and discussions were subsequently held with representative members of the various branches of the engineering profession, one of the points for discussion being the disinclination among manufacturing engineering firms to afford special facilities to students who have gone through college courses of study. The conference was divided into sections, namely: (1) Railway, Railway Mechanical and Dock Engineers; (2) Municipal Engineers; (3) Waterworks and Gasworks Engineers; (4) Manufacturing Engineering Firms; (5) Engineers in Private Practice. There was no special section for electrical engineers, whose work now covers a very wide field, including a knowledge of railway engineering, mechanical engineering, and mining engineering, and touches more or less intimately all known branches of engineering, but from the point of view of the conference perhaps that which bears most directly upon electrical engineering training is the evidence given by manufacturing engineering firms, and engineers in private practice.

In the manufacturing section Mr. Andrew M. Alexander, speaking of his experience at the Thames Iron Works, said that he adopted a three years' system of pupilage, of which two years were spent in the works and the third in the drawing office—designing, drawing, estimating and the like. The only entrance conditions were that the pupil should have received a good general education, followed, if possible, by a technical course at a university or equivalent institution. If not already qualified for admission as a student of the Civils he had to undertake to qualify if possible during the first year. He was encouraged to continue his studies, particularly in any subject he was weak in, and in subjects bearing upon the work he was in close touch with during the day.

On the first Monday in every month the pupil had to present to Mr. Alexander a report with sketches or photographs so as to accustom himself to the method of reporting.

A small premium was paid which was returned in wages. No undertaking was given as to future employment; that rested largely with the man himself, but generally speaking a pupil was appointed as resident engineer in charge of works carried out by the company, and in this way got a start in a professional career. Mr. Alexander himself took a personal interest in all his pupils. He gave instances of several men who had passed through the Thames Iron Works and were now occupying responsible positions at home and abroad.

Mr. Alexander referred to the question of specialisation. In medicine and law, he pointed out, one becomes a general practitioner first and a specialist last, but in engineering the reverse is generally the case. On coming from his technical college a pupil is put on to the building of large dock gates, bridges and so forth, and gets his mind full of what is called structural steel work; then after his three years' pupilage he may get a berth with the public works department, and be sent to India on irrigation work and do very well at it. He thought it a remarkable thing that a man could go from special to general work, but he had come to the conclusion that it did not matter very much where a man was placed for his practical work if he had a sound education. He found also that men who had been highly educated were those who worked with the greatest zest and best will and the greatest activity, glad to have the privilege of blacking their hands. Moreover they were generally the most popular with foremen, supervisors, inspectors, and so on.

Mr. Alexander's view generally was that the best course is for a man to matriculate as early as possible, then obtain the best college course he can, say in three, or better, four years, then go to some member of the Institution who has the opportunity and will to educate him, and spend three years in a works or on a contract.

(To be concluded.)

IMPORT TRADE OF SWEDEN.

The following figures showing the imports in 1912 into Sweden of electrical and allied goods are extracted from the official trade statistics which have just been issued. The figures for 1911 have been added, and increases or decreases shown, but owing to alterations in the official classifications, it will be noted that the sub-divisions of electric wire and cable imports are not comparable in detail but only in the totals:—

	1911. Kronor.	1912. Kronor.	Inc. or Dec. Kronor.
Electric meters.—			
From Germany	692,000	808,000	+ 116,000
,, Great Britain ...	68,000	81,000	+ 13,000
,, Other countries ...	7,000	7,000	—
Total	767,000	896,000	+ 129,000
Electric incandescent lamps.—			
From Germany	929,000	1,016,000	+ 87,000
,, Austria-Hungary ...	20,000	16,000	– 4,000
,, Holland	91,000	—	– 91,000
,, Other countries ...	16,000	26,000	+ 10,000
Total	1,056,000	1,058,000	+ 2,000
Dynamos and parts thereof.—			
From Germany	162,000	200,000	+ 38,000
,, Great Britain ...	—	14,000	+ 14,000
,, Switzerland ...	23,000	—	– 23,000
,, Other countries ...	16,000	8,000	– 8,000
Total	201,000	222,000(a)	+ 21,000
(a) Over 500 kg. in weight.			
Electric motors and parts thereof.—			
From Germany	468,000	389,000	– 79,000
,, Great Britain ...	12,000	16,000	+ 4,000
,, Switzerland ...	—	13,000	+ 13,000
,, France	11,000	—	– 11,000
,, United States ...	19,000	19,000	—
,, Other countries ...	34,000	34,000	—
Total	544,000	471,000(b)	– 73,000
(b) Up to 500 kg. in weight.			
Electric cables covered with lead.—			
From Denmark	—	35,000	+ 35,000
,, Germany	5,215,000	3,976,000	– 1,239,000
,, Holland	49,000	59,000	+ 10,000
,, Great Britain ...	267,000	405,000	+ 138,000
,, Other countries ...	5,000	33,000	+ 28,000
Total	5,536,000	4,508,000	– 1,028,000

	1911. Kronor.	1912. Kronor.	Inc. or Dec. Kronor.
Turbines.—			
From Germany	33,000	No	—
,, Great Britain ...	7,000	details.	—
Total	40,000	4,000	– 36,000
Telephone and telegraph apparatus.—			
From Germany		47,000	—
,, Great Britain ...	No	32,000	—
,, Other countries ...	details.	29,000	—
Total	18,000	108,000(c)	+ 90,000
(c) Includes wireless apparatus 11,000 kr.			
Transformers and parts thereof.—			
From Germany	242,000	97,000	– 145,000
,, Switzerland ...	16,000	—	– 16,000
,, Other countries ...	6,000	14,000	+ 8,000
Total	264,000	111,000	– 153,000
Accumulators.—			
From Germany	796,000	999,000	+ 203,000
,, Great Britain ...	27,000	—	– 27,000
,, Other countries ...	2,000	7,000	+ 5,000
Total	825,000	1,006,000	+ 181,000
Rheostats, switches, etc.—			
From Germany	799,000	657,000	– 142,000
,, Switzerland ...	24,000	—	– 24,000
,, Denmark	40,000	—	– 40,000
,, Other countries ...	18,000	38,000	+ 20,000
Total	881,000	695,000	– 186,000
Elevators.—			
From Germany	19,000	14,000	– 5,000
,, Other countries ...	18,000	9,000	– 9,000
Total	37,000	23,000	– 14,000
Cranes.—			
From Germany	255,000	118,000	– 137,000
,, Great Britain ...	109,000	138,000	+ 29,000
,, Other countries ...	93,000	44,000	– 49,000
Total	457,000	300,000	– 157,000
Copper wire of at least 0.5 mm. diameter (new classification in 1912).—			
From Germany	No	356,000	—
,, Austria	details.	17,000	—
Total		377,000	—
Copper wire, twisted, and cable not insulated.—			
From Germany	79,000	66,000	– 13,000
,, Other countries ...	5,000	3,000	– 2,000
Total	84,000	69,000	– 15,000
Copper wire covered with textiles.—			
From Germany	11,000	No	—
,, Other countries ...	2,000	details.	—
Total	13,000		—
Copper wire covered with rubber.—			
From Germany	No	No	—
, Other countries ...	details.	details.	—
Total	3,000		—
Copper wire otherwise insulated.—			
From Germany	320,000		—
,, Great Britain ...	21,000	No	—
,, Other countries ...	1,000	details.	—
Total	342,000		—
Other electric cable.—			
From Germany	404,000		—
,, Great Britain ...	29,000	No	—
,, Other countries ...	1,000	details.	—
Total	434,000	4,000	– 430,000
Steam boilers.—			
From Germany	68,000	319,000	+ 251,000
,, Great Britain ...	26,000	20,000	– 6,000
,, Other countries ...	16,000	47,000	+ 31,000
Total	110,000	386,000(d)	+ 276,000

(d) Includes feed heaters and gas generators.

Krone = 1s. 1½d.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

(*Abstract of Inaugural Address by* Sir John Snell, President I.E.E., *delivered on Oct. 29th*, 1914.)

With faith in the ultimate triumph of our cause, every corporate body like this Institution must persevere in its normal and proper duties and must perform them faithfully and diligently. Electricity enables us to command the seas, through messages and directions sent to our glorious navy, and to maintain communications with distant parts of this Empire. We thus obtain our food supply and maintain our trade, without which our whole social fabric would be paralysed. We may indeed be thankful that in this war which we did not seek, but which for our national honour and, perhaps, one may add, for our existence as a great empire, we were obliged to undertake, the discoveries and experiments of Faraday, Hertz, Preece, Lodge, and Marconi, to mention only a few of those who have assisted to develop wireless telegraphy, have enabled such dispositions to be made by those in command as, it may be hoped, will more speedily bring to an end this calamitous struggle.

Much criticism has been levelled against the Council on account of the formation of a short-lived Industrial Committee and its subsequent disbandment. It is really a very difficult matter to deal with, much more so than critics appreciate. Some of the matters referred to this committee were of a controversial nature, and to give decisions on controversial subjects affecting two sections of the industry which may happen to be opposed in their views must necessarily involve serious and sometimes insuperable difficulties.

In my opinion there must be, apart from the Institution, separate bodies who will deal with their own immediate and particular interests. The Incorporated Municipal Electrical Association, for instance, deals particularly with municipal interests, and has done and is doing splendid work. The British Electrical and Allied Manufacturers' Association deals with the commercial and industrial details of the great electrical manufacturing interests and has become a powerful organisation. The Electrical Contractors' Association, again, deals with the contracting side of electrical work, more particularly consumers' installations; the Tungsten Lamp Association with metal lamps; and the power companies have their own interests to watch, and so forth. In certain cases the interests of two of these bodies may be diametrically opposed, and yet the members of most of them are united within this institution. In view of this possible conflict of interests, it would obviously be impossible for the Institution to exercise functions such as those which the various sectional Associations so successfully carry out, each one from the point of view of the particular section of the electrical profession which it represents. On the other hand, the Institution must adopt not only a sympathetic attitude towards each and all of them, but also be ready to help them or, if asked, to arbitrate between them.

There is this essential difference between the Institution and any one of the sectional associations. The Institution has to consider electrical progress as a whole, while, on the other hand, each association has its own particular sectional interest to advance. It is in that sense that there must be sectional associations apart from the Institution, and that the Institution must maintain a broad and impartial outlook over the whole profession and electrical industry.

We ought also to be well informed on all legislative matters affecting the use of electricity, to be prepared to assist Government Departments when required, and to make representations to them when necessary in the interests of electrical development.

The Council defined their attitude towards such interests in their last annual report. I think all members, except, perhaps, a few extreme sectarians, will desire that the Council should preserve an absolute impartiality towards all sections of the profession; but that must not be interpreted as standing aloof and doing nothing to promote the interests of the profession as a whole.

I think some organisation can be created which will be constantly ready to consider any question that may arise from among the many sectional interests which the Institution incorporates. The most flexible organisation that I can suggest is the formation of a standing advisory committee, composed, say, of the president, three past presidents, and three members of council. There must be, first, some continuity of action on the part of such a committee, and that is why I suggest that some of its members should be past presidents, otherwise the committee would be continually changing its personnel. On the other hand, three members of council and the president for the time being would bring in fresh blood. This standing advisory committee might be given power to add to its number, choosing from among other members of the Institution. I do not know, of course, how this suggestion will commend itself to the Council, and it must be understood that I am only expressing my own opinion.

Suppose a Government Bill be brought in to amend the Electric Lighting Acts, I would suggest that the draft Bill

should be referred to the Advisory Committee for report, the Committee thus acting as a Parliamentary Committee. A few outside corporate members or associates would be invited to join them *ad hoc*, and so a strong committee, including these specially co-opted members, would deal with the particular subject; and when the particular work was done the co-opted members or associates would be released from their duties, though the nucleus committee would remain.

Or again, suppose a difficulty were to arise between two sectional associations, and suppose the Council were invited to compose the difficulty. The advisory committee would again invite certain members fully experienced in the subject in dispute to join them for the time being; and thus the best thought would be brought to bear on the subject. Conferences with both parties could be held, and it may be hoped that either a fair compromise would be arranged or a direct report made to the council that some definite attitude should be adopted by them and that the Institution's influence should be directed in some specific direction.

The ultimate power to act must of course rest with the council, who clearly cannot delegate their powers and responsibilities to another body. Much time would have to be given by this committee to the interests of the Institution in order to do effective work, and the duties would certainly be heavy; but if the result is likely to be good there are many among us who would give our services freely.

The greater part of the work must necessarily fall on members residing around London, and in the advisory committee which I have outlined the nucleus would probably have to be formed from London members; but specially co-opted members could be drawn from any district.

It has been suggested that the Institution could do good work by organising lectures in various parts of the country so as to educate people in the application of electricity to various kinds of industrial power, or in the advantages of electric lighting or of electric heating and cooking. I do not for a moment say that all proper means to develop the use of electricity should not be adopted, but it would seem from my past experience that lectures and demonstrations can be best dealt with by local organisations, such as the municipal and company-owned electricity undertakings and their commercial departments. I think they are then more effective.

One good piece of work has been recently accomplished by the issue of the new "Model General Conditions for Contracts." I myself think that these conditions establish a very fair relationship between the purchaser, the contractor, and the engineer respectively; and it may be hoped that they will find general acceptance and adoption.

Remuneration of Young Engineers.

In what way can the Institution help the younger men? The Council have been asked at various times to assist in finding positions for their younger brethren and to regularise and improve the status and pay of young engineers. In a general way, and in time, the improvement in the status of associate members, due to the system of examinations and the qualifications now necessary, will have a good effect in this direction. I do not see, however, that the Institution can very well become either a trade union or even a labour bureau.

That there are serious causes for complaint from the younger electrical men I am certain. Let us look for a moment at some of the causes. One of them is supply and demand. If, for example, a vacancy for a junior occurs in a power station, the moment the post is advertised there is a crowd of applicants, with the result that the next time a similar vacancy occurs the salary offered is sometimes less than before. That, undoubtedly, is one cause of low salaries. I would ask fellow-members who are heads of departments to do this—to give so far as is reasonable and proper a preference to applicants who belong to the Institution (in a very short time this qualification should be indispensable); and in fixing salaries, do not think so much of recording a small fraction of a penny less per unit sold on the costs sheets, but remember first that we were all at one time juniors, that the price of living has gone up and is going up, and that the best can be expected from anybody only if he is adequately paid, and if reasonable opportunities for advancement are held out to him. I know it is difficult, because engineers and managers are not always able alone to deal with such matters. There are municipal committees or boards of directors who are naturally anxious to see good returns. Nevertheless, chief officers can do good service to their younger brethren if they choose.

Another cause in many cases has been the want of thorough training—sometimes too much time has been spent on theoretical training and not enough on practical work—or in other cases there has been workshop experience without proper or sufficient technical training. This want of balance is rapidly being put right, thanks to the co-ordinated efforts of our universities and technical colleges.

I hope that as the result of the various remedial forces now at work the remuneration of electrical engineers during the earlier stages of their career will soon be improved.

National Service.

patriotic and untiring service to this cause, circularised the members of the Institution at the instance of the specially appointed National Service Committee, a very large number of our members of all classes—nearly 500—offered their services. A very large majority volunteered either for service at home or abroad. Acting in company with the President and Secretary of both the Institution of Civil Engineers and the Institution of Mechanical Engineers, it was first suggested that these three institutions should form an "Engineering Institutions" Battalion for service in the field, and that we should clothe, house, feed, and train the recruits, so that when ready the battalion could be handed over to the War Office in a condition of complete readiness. The Institutions of Civil and Mechanical Engineers readily gave the weight of their influence to the movement, and in our own case we are particularly indebted to one of our members, Major-General R. M. Ruck, C.B., R.E., for his invaluable counsel and assistance and for his influence at the War Office.

There then came an unexpected proposal that the three principal engineering institutions should recruit the Engineer Units for the Royal Naval Division, just then authorised to be formed. The response from members of all classes of all three institutions was so spontaneous that the corps was formed within a few days by men not only of splendid physique but also of highly skilled intelligence, professional men trained in various branches of engineering, and forming a personnel of the highest value to the Admiralty. All three institutions owe Mr. W. Duddell, F.R.S., Mr. A. P. Trotter (who was one of the originators of the movement), Mr. Robert Hammond, Colonel D. E. Ruck, R.E., our Secretary, Mr. Rowell, and the staff of the Institution, who were all indefatigable in their labours as recruiting agents, a great and lasting debt for their untiring energy and enthusiastic assistance in this loyal movement which has met with so great a success.

It is not the first time that this Institution has been instrumental in showing its loyalty to our King and to the Imperial cause. The Electrical Engineers (Territorial) R.E. Battalion is in the King's service to-day, and the members of it are on duty under the command of my old friend Lieut.-Colonel Le Rossignol, R.E., at several of our important defence works. Many of our members are also serving in the Signalling Corps of the London Army Troops under Colonel E. H. Leaf, R.E., men able to utilise their skilled experience in telegraphic and wireless services. Many others of our members have also joined other regiments.

Legislation.

Except in the further facility needed to allow undertakers to establish show-rooms and to let fittings on hire, with due regard to the interests of electrical contractors, one does not see that much improvement can be suggested on the present laws affecting the supply of electricity.

The Electric Lighting Bill which it is the desire of the Municipal Association to have placed on the Statute Book is one of very great importance to the whole industry. The Bill, as now drafted, is receiving the support of the Manufacturers' Association, but I understand that the Contractors' Association does not approve of it. I have carefully read the Bill, and, speaking from an entirely detached and independent position, I cannot feel otherwise than that non-agreement is regrettable and contrary not only to the public interests, but to the interests of the contractors themselves. Contractors will not be competed with by the supply authority in any wiring contracts, since the proposal is that undertakers "shall not themselves execute the wiring of private property," but they will be placed in competition undoubtedly in "providing, selling, letting on hire, fixing, repairing and maintenance of fittings, apparatus and appliances for lighting, heating, and motive power," though there are proper safeguards to prevent the public authority from undercutting contractors.

Surely a reasonable compromise could be arrived at which would be mutually advantageous. Increase of business should be the first direct result of the passing of a Bill of this nature, and therefore more wiring contracts.

This is a case where, in the public interest and in the general interest of the whole electrical industry, the addition of such a measure to the existing Electric Lighting Acts would appear to be of immense value to all interests—municipal or company undertakings, manufacturers, and, in my opinion, contractors. A way should be found to pass it in a form which would bring the greatest benefits to contractors as well as to the supply authorities.

Let me now turn for a time to some of the problems which are constantly before us and with which one is often called upon to deal.

Bulk Supply.

Take first the question of bulk supply. I do not want now to enter into the matter controversially, and will deal only with what I think are facts. There is no doubt, were we beginning anew, that instead of each small local authority putting down an independent power station, considerable waste of money and fuel would be avoided by establishing one large system for several adjacent areas supplying energy to each smaller area for local distribution. Even in some cases where there are existing small power stations, some of them unfavourably situated for cheap generating costs, it would probably pay to extend one of the better placed stations only and to supply the others therefrom rather than to extend each local station from time to time.

Unfortunately there are the somewhat narrow views of some of the local engineers and local councils which prove to be serious obstacles. There is, however, another side to the question. It may be generally said that once a small station is built and the expenditure has been incurred, then and so long as the system is kept within defined limits of extension, the *extra* operating cost of an addition to the local power station is often cheaper than any commercially feasible bulk supply. I have had to enquire minutely into many such cases, and in most of them the decision has necessarily been

to extend the local plant. No commercial alternative was possible.

A case arose a short time since where a comparatively small station—less than 2,000 KW.—required supplementing. The annual load factor, based on 30 minutes' sustained load, was 36 per cent. A neighbouring very large undertaking offered a bulk supply at very low terms—far lower than any terms yet mentioned in the various London power schemes. It was impossible to demonstrate that it would pay to purchase all the energy locally required from the bulk supplier, because of the dominating effect of the capital outlay and the standing charges on the existing local plant, which, of course, had to be paid whether the bulk supply were taken or otherwise. It was difficult to show any economy from the bulk supply when compared with the extra operating cost resulting from an extension of the local plant. Finally, the best terms were made for both parties by the local station undertaking to run its plant for one shift during only four months of the year, thus entirely taking the local load off the winter demand of the bulk station—that is to say, a co-operative system such as was proposed in the original London County Council schemes seven years ago.

I am firmly of opinion that no economy can be shown in the generality of cases where there are modern and properly managed undertakings whose capital expenditure on buildings and plant is not yet redeemed or written off, unless energy can be supplied by a bulk authority at rates not exceeding £2 10s. per kilowatt of maximum demand and 0.25d. per unit delivered for untransformed high-tension energy. In many cases the bulk figures would even have to be lower. We hear much of the benefits of bulk supply—there are benefits in certain cases, admittedly—but committees are often misled by receiving a proposal to pay £3 per kilowatt and 0.25d. per unit sold to them, which at first sight, when resolved into the particular price per unit, appears to be so much less than the local costs of generation. It is not always understood by the committees, or even by the public or non-technical Press, that many additions have to be made to the bulk figure before a proper comparison can be made with the local costs. When these other additions are made it is found that the bulk authority's figure is, of course, considerably enlarged. Yet one often finds that comparisons are wrongly made between the quoted bulk figure and the local cost. Such unskilful comparisons are injurious to the public interest, disseminate false ideas, and cause much trouble.

While this problem of assisting local stations from a bulk authority gives rise to these difficulties, it is generally true that a new local area about to install an electrical system would do well first to obtain terms from a reliable bulk-supply authority, if available, before deciding to build a local power station. Better still, in many cases, while the local authority would find the capital to build its local sub-stations and to lay its distributing network at probably cheaper rates of interest than a bulk authority can raise money, it can reduce expenses to a minimum by arranging for all the administrative work and upkeep of the local system to be undertaken, under proper supervision, by the bulk authority, the local authority only collecting the revenues.

What we all desire to see is electricity sold at the cheapest rate and at a reasonable profit to consumers, whether of the industrial or residential classes, at the same time to avoid

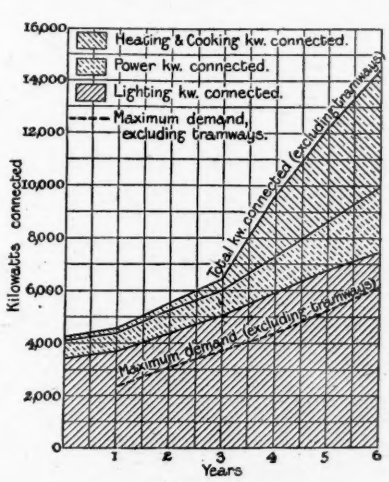


FIG. 1.

waste of capital and not to incur unnecessary working expenses. Such a policy means more consumers, greater output, more plant and apparatus, and is good for the industry and for the nation in every way.

The Local Government Board, which controls to a limited extent the expenditure by the various municipal electrical undertakings that represent the great majority in this country, could do much in this direction. I should like to see a complete survey made by the Board of the present position of all the electrical authorities, so that in those cases where amalgamation of electrical interests, or purchase of energy from some outside source for local distribution, ought rather to be adopted in lieu of a local extension of plant, the Board would decline to sanction any loans for the proposed extension of local plant.

A thorough survey of the position in this manner, and consequent action on the lines suggested, might not only save public money but would also conserve our stores of coal, and therefore be of ultimate service to the community. Moreover, it would enable the public systems thus to supply consumers on the most favourable terms. I do not at all say that this can be done universally, but I do know that there are several groups of undertakings where concentration on the lines which I have suggested would produce economies.

Domestic Supply.

Another matter of great interest to us all at the present time is the domestic supply. To my mind it is an unnecessary cost to the consumer and a brake upon progress to require two sets of wiring in any one residence. The supply for lighting on the one hand, and for heating and cooking on the other, should not be differentiated in the consumer's installation. Let us endeavour to remove all unnecessary barriers to a generally increased use of electricity. One meter and one set of apparatus generally would then suffice, with a consequent less cost per service to the supplier.

I have had during the last two years to enquire exhaustively in more than one instance into the cost of supplying electrical energy for heating and cooking. It is a fact that there is a very great diversity indeed between the lighting and cooking loads, whether in London or in the provinces. Fig. 1 reproduces an actual case. While the lighting and power connections are steadily rising, the heating and cooking connections are increasing at a greatly accelerated rate; but as will be seen, the maximum load on the power station is rising proportionately to the lighting and power only, and is practically unaffected by either the heating or cooking additions.

Several important things are shown by this, namely—

(*a*) A greatly improved annual load factor.

(*b*) The great diversity between the heating and cooking loads and all other classes of supply.

(*c*) Not only the consequent better utilisation of the generating plant, but also of the feeders and distributing mains.

Analyses of daily load curves showed that the daily load factor in the summer had increased from 26 per cent. to 37 per cent. for comparable days in three successive years, and in the winter from 38 per cent. to 42 per cent. The effect on the daily load factor of this increased domestic supply is therefore more marked in the summer than in the winter, and this result would have been expected. The whole effect in this instance is to level up the daily load factor throughout the year. Confirmatory results have also been obtained in other districts. It is safe to say that a great increase in the output for the purposes of domestic supply must be expected and must be provided for. In some cases I find that the ratio of other domestic units to the lighting units is as high as 10 to 1. An average of all the private residences in one provincial town gave a ratio of 3.5 to 1; shops, however, only gave a ratio of 1.2 to 1, while offices gave the highest ratio, viz., nearly 5 to 1. It is probable than in the near future existing consumers who now take energy only for lighting or heating to a very limited degree will be purchasing from 4 to 5 times the number of units metered at present. This will mean a very greatly increased output and improved load factors. Increased load factor and larger output will react on and reduce the costs of production. Increased output of utensils and apparatus will reduce their cost also, coupled with the constant improvement in the apparatus itself, and in its efficiency and durability. All of these factors are favourable to a greatly increased use of electricity.

I look forward to a general rate of 1d. per unit for domestic supply; but the time is not quite ripe yet. For the present, most undertakings must have recourse to a modification of the Hopkinson system, that is, either to a fixed charge per kilowatt (or fraction of a kilowatt) connected, plus a minimum charge per unit metered; or, where assessments permit, a fixed charge based on the rateable value, plus the running charge per unit metered.

Future Charges to Consumers.

What are the prevailing figures now? Energy for domestic lighting costs, say, 2½d. per unit; the cost of power varies from 1d. down to ½d. according to the load factor, size, and kind of supply (*i.e.*, whether transformed and converted, or untransformed high-tension energy). Special supplies are given under exceptional circumstances, such as restricted hour, non-peak loads, at still lower rates such as 0.15d.; these, however, may be termed by-products. The average cost to the consumer in this country is now 1.56d. per unit, and in London it is 2.15d. I do not know any other country that can show as good figures, except in one or two instances of exceedingly large supplies to railways and traction systems.

It may be worth while to consider what possibilities lie before us so far as we can now foresee. There are so many factors to be considered that without considerable sacrifice of capital and a complete change in public custom and opinion, one cannot reasonably look to the whole electrical supply in a province being given by one system. Undertakings above a certain size and output are bound to continue independently.

Let us suppose, however, an ideal case of generation on a large scale in power stations dependent on fuel, and transmission

to various parts of an extended province, partly by overhead lines, partly by high-tension cables, the transmission pressure being, say, 30,000 volts. Suppose, further, that the output embraces a supply to transportation systems (railways and other traction systems), wide classes of industries, such as chemical works, collieries, mills, shipyards, engine works, and also that the domestic supply reaches the extended application which I have suggested. The resultant average annual load factor at the power stations might then possibly reach 50 per cent. It seems to me physically impossible to expect a higher resultant figure over the whole generating system. The undertaking equipped with large generating sets and simple inexpensive buildings, could be erected for about £8 per kilowatt installed. That must be considered to be absolutely a minimum. The average cost per unit sold, including 5 per cent. interest on capital and adequate depreciation, would be 0.54d.

This means that prices such as the following properly assessed charges would have to be made to consumers of various kinds, allowing for a reasonable diversity factor:—

Class of supply.	Consumers' annual load factor.	Average proper price to be charged.	Probable future tariffs.
	Per cent.	d.	
Lighting ...	12·5—15	1·200	1½d. { domestic
Heating and cooking	40—45	0·447	½d. { average rate, ¾d.
Power	20	0·77	} ¾d. to ½d.
	25	0·64	
	30	0·554	
Public lighting	35	0·493	½d.
Special power, *e.g.*, mills	40—80	0·447 to 0·286	½d. to 0·3d.
Special non-peak loads		Down to 0·15d.	

These costs for various load factors are shown graphically in fig. 2.

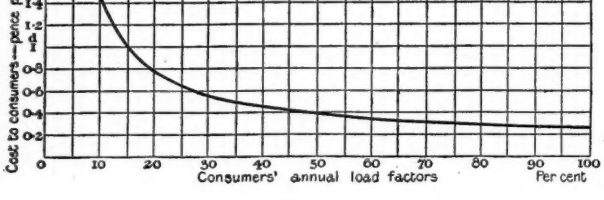


Fig. 2.

The two principal items of costs are fuel and capital charges. Now imagine some system of generation by which the cost of coal could be eliminated—such as the sale of by-products, which would balance the coal cost. The average cost of 0.54d. would only be reduced to 0.40d., and the average charges to lighting consumers would still have to be 1½d., while industrial consumers with ordinary load factors would have to pay prices ranging from 0.66d. to ¼d. if the costs were properly apportioned.

Or, again, suppose the capital cost of the complete undertaking were reduced to half of that taken as a basis in the above figures, which would mean only £4 per kilowatt installed for the power house, and £12.5 per kilowatt installed for the sub-stations and mains (figures one may safely say cannot in any reasonable probability be ever reached); still the average cost of a 50 per cent. load factor would be 0.42d., and the lowest permissible charge to a lighting consumer would be 1¼d., and to an ordinary industrial consumer from ¾d. to ¼d. Thus we see the probable limitations of the reduction in cost of electrical energy supplied from power stations other than hydro-electric systems. In the latter the capital cost is generally the important factor, and the cost of production may be as high as that in a large steam-driven station.

It is therefore most unwise to talk about giving a general supply at ¼d., or even ⅛d. per unit. It is easily demonstrated that such figures are unattainable with any known methods, or from any developments which seem to be within the region of possibility.

In this country we are to a great extent dependent on coal for the maintenance of our industrial position. Coal is one of our great national assets, and it is lamentable to think how grossly it is wasted. It would pay in all but the smallest stations to have an assistant whose duties would wholly consist in noting the thermal values from the coal consumed right down to the remaining value per unit delivered to feeders, so as to improve the results and to minimise waste.

Capital Investment in Electrical Works.

As an indication of the development of electrical undertakings and companies in the British Empire, the following figures show a remarkable amount of capital invested.

	£
310 Manufacturing companies	46,703,047
178 Miscellaneous companies	8,756,417
Telegraphs and telephones	37,249,088
269 Electrical supply companies	58,364,885
262 Municipalities	49,656,951
104 Tramway undertakings	56,012,466
	£256,742,854

This huge total does not even then include Government telegraphs and telephones, power companies, or the capital invested by railway companies in electrification, which would greatly increase this total. It is nevertheless a very large amount, and is an indication of the great importance which the electrical industry has attained. When one considers that in a period of 30 years over 250 million sterling has been invested in electrical undertakings of various kinds, none can deny that electricity has become indispensable to the service of mankind.

Trend of Improvements.

We are gradually arriving at definite and accepted methods. In power-station work there can be no question that three-phase generation has such great advantages over any other system that it must be generally accepted as the system of the future. Turbo-alternators of the highest adaptable speed coupled to machines of simple design (by simple machines I mean one bar per slot) having the lowest consequential terminal pressure—stepping up through static transformers (thus giving the necessary protective reactance) to the switchboard busbar pressure—are almost certain to be generally adopted. Higher feeder pressures, now that insulated cables for very high pressures are commercially practicable, will no doubt be used, and distribution by the three-phase four-wire system will in my opinion be adopted wherever possible.

In the manufacturing section, steady progress towards standardisation is being made. If plant of whatever kind can be turned out in quantities, the articles are cheaper than when the stock order is small. Some continental competitors have realised this, and by absorbing the fixed charges at home, have delivered machines and materials here at prices which have been based on the "running costs" only. In so doing, however, they have improved their own factory load factor and increased their prosperity. Our manufacturers have an opportunity now, and if they will turn out standard plant more boldly and in numbers, economies to suppliers and purchasers alike will result, and increased output.

Steady progress is being made in our designs by the better utilisation of raw materials. There is now very little superfluous iron, steel, or copper in our generators and motors. In our distributing systems I am not so sure that we have made the same progress.

If we turn to railway electrification we seem as yet no nearer a solution of the rival claims of the overhead high-pressure system and the third rail. The tendency in this country is certainly in favour of the latter, because the great railways are confining themselves to suburban traffic, for which the third rail has decided advantages.

We have also to consider the equipment of lines in British Dominions and of British-owned foreign lines, where coal is generally so much dearer. In many of these cases, owing to the long distances to be traversed, it would seem necessary to adopt an overhead high-pressure system. There can be no doubt that the economic effect of suburban electrification in this country has been markedly successful, and has resulted in improved returns to those railways which have adopted it, and we can confidently expect that wherever commercially practicable further electrification will follow.

This is largely a commercial age, but while not neglecting the obviously necessary attention which we must give to commercial and industrial interests, let us not under-estimate the great privileges that we electrical engineers especially enjoy of understanding more clearly and of effectively using the great natural forces, in the utilisation of which electricity has been such a powerful agent; or of comprehending with clearer vision natural laws and the creative design that underlies and controls them all.

War and the Professional Classes.—Many members of the professional classes have been severely hit by the war and are already in distressed circumstances; an organisation has been formed under the title "The Professional Classes War Relief Council" to discover such cases, and to afford what aid is possible, by advice and indirect help rather than by monetary assistance. The main object is to bridge over the temporary difficulty caused by the war, and to pave the way to permanent and profitable employment. The education of children, maternity assistance, emigration, the provision of temporary employment, &c., will receive attention. For some purposes a fund will be necessary, and donations are invited, to be addressed to the Treasurer of the Council, 13 and 14, Princes Gate, S.W. The provisional Chairman is Major Leonard Darwin, who is supported by a large body of distinguished men and women. A large house has been lent for the Maternity Nursing Home, and Mrs. Hills, 32, Prince's Gardens, S.W., will be glad to receive offers of furniture of all kinds on loan or as gifts.

HEATING AND INSULATION DETERIORATION OF CURRENT-CARRYING CONDUCTORS.

A voluminous report dealing with theoretical and experimental investigations on this subject was published some time ago by the Electrotechnical Laboratory of Tokio.* The main object of the research was to establish general formulæ for the temperature at any point in the covering of insulated conductors, and for the insulation resistance and breakdown voltage of the covering as a function of the temperature of the conductor, and thus of the current carried. The experiments were conducted with cleat-suspended wiring, such as is generally employed in Japan, but the theoretical formulæ established are applicable to any case, and include :—(1) Formulæ for temperature rise as function of current carried. (2) General and approximate formulæ for insulation resistance as function of current carried and room temperature. (3) Formulæ for breakdown voltage. The thermal and electrical constants involved by these equations being determined by experimental investigation of the thermal and electrical characteristics of various covering materials, "practical" formulæ have been derived by substitution in, and simplification of, the general theoretical formulæ.

As our readers are doubtless aware, the theoretical investigation of this subject involves cumbersome equations—particularly where multi-layer coverings are concerned. The mathematics involved is not difficult, but the cumbrous nature of the expressions derived forbids their reproduction in these columns. Even the "practical" formulæ are so formidable in appearance that their actual practical application must be limited. Fortunately, however, the author has himself applied his formulæ to the calculation of certain useful tables, which are presented in the appendices to the report, and are reproduced in abstract herewith.

Insulating Materials Investigated.—The conductors investigated were covered with :—(1) High-grade insulation (pure, separator and jacket rubber, cotton tape, and impregnated cotton braid) ; (2) low-grade insulation (vulcanised rubber and cotton braid ; (3) Tokio-Sen (impregnated cotton). Analysis of the three classes of rubber concerned gave the following results :—

Rubber.	*Separator.*	*Jacket.*	*Vulcanised.*
Specific gravity ...	1·695	1·693	1 679
Rubber...	38·93 %	22 90 %	16·04 %
Rubber substitutes ...	1·94 %	5·57 %	7·92 %
Sulphur—combined ...	1·16 %	6·85 %	8·12 %
,, free ...	0·72 %	0·23 %	0·40 %
Fats and resins ...	0·40 %	9·53 %	13·45 %
Bitumens	nil.	0·30 %	1·00 %
Ash	53·56 %	54·85 %	53 48 %
Loss at 120° C. for 1 hr.	1·19 %	2·11 %	1·16 %

Methods of Measurement.—The temperature rise of conductors was calculated from the change in ohmic resistance, and the temperature of insulating coverings was determined by aid of specially constructed iron-constantan thermo-couples. For the insulation resistance and breakdown voltage tests, gas-heated water baths were employed. Insulation resistance measurements were carried out at 5° C. intervals by the deflection method, charging being effected by the application of 100 volts, D.C. for one minute, and lead-sheathed wires being used to secure an outer electrode during "dry" tests. Dielectric strength measurements were carried out at 10° C. intervals up to 80° C., using 50-cycle alternating current.

Specific Resistance of Copper. — For the constants in the equations—

$$R_v = \rho_v (1 + a.t + b.t^2) \text{ microhms per cm. cube,}$$
and $$R_m = \rho_m (1 + a.t + b.t^2) \text{ ohms per metre-gramme,}$$

the author finds the following values :—

Copper.	*Hard drawn.*	*Soft.*
ρ_v	1·5862	1·5640
ρ_m	0·1409	0·1394
a	$4{,}192 \times 10^{-6}$	$4{,}218 \times 10^{-6}$
b	$16{\cdot}4 \times 10^{-9}$	291×10^{-9}

Specific Conductivity and Emissivity.—Theoretical formulæ for the specific conductivity K and the radiation coefficient E (watts per sq. cm. per 1° C. temperature difference) are developed, and the following average values are given for E and K :—

	E × 10⁶	K × 10⁶
Rubber—pure	—	140
,, separator	647	318
,, jacket	561	387
,, vulcanised	565	484
Cotton tape	552	434
Impreg. cotton braid—high-grade ...	514	288
,, ,, low-grade ...	520	323
High-grade insln. (as specified above) ..	552	224
Tokio-Sen	510-530	400-300
Lead	346	74,800

Insulation Resistance.—Formulæ expressing insulation resistance as an exponential function of temperature are inconvenient. A quadratic equation of the form—

$$k = k_0 (1 - a.t + b.t^2)$$

is sufficiently accurate for practical purposes, and is actually more accurate the smaller the temperature difference concerned. Average values of k_0, a and b, for temperature ranges from 15° to 35° C., and from 35° C. to 55° C. (normal and summer conditions), are given in the following table. The right-hand column in the latter

Applicable between	15° and 35° C.			35° and 55° C.			Recovery of k at 20° C.
	k_0	$a \times 10^6$	$b \times 10^6$	k_0	$a \times 10^6$	$b \times 10^6$	
Rubber—pure—dry ..	19,475	33,060	386	11,652	30,649	249	51·3 %
—separator—wet ..	1,562	50,056	672	627	33,873	296	12
—dry ..	1,535	46,582	596	746	39,223	271	59
—jacket —wet ..	7,802	52,704	732	2,599	35,263	318	36·6
—dry ..	9,733	52,704	732	3,242	35,263	318	42·8
Common grade insln.—wet	2 967	47,393	609	1,246	33,655	292	55
—dry ..	3 121	49,224	651	1,336	33,690	116	57
Tokio-Sen	5,030	44 386	549	2,759	31,468	260	100

shows the percentage recovery of insulation at 20° C. (during 12 hours' gradual cooling). The values for k_0 are in 10^{12} ohms per cm. cube.

Dielectric Strength.—A small irregularity in the nature or thickness of the insulating covering affects very greatly the breakdown voltage of the latter, and, at temperatures up to 40° C., considerable discrepancy was observed between the dielectric strengths of pieces from the same sample of wire. At higher temperatures, however, the deteriorating effect of heating predominated, and samples of the same grade of wire broke down at practically the same pressure. Low-grade insulation does not fail by rupture, but is ultimately burnt by the leakage current. Whereas low-tension wires require a covering of high insulation resistance, high-tension insulation is graded for high dielectric strength. The author finds that the breakdown voltage for pure and separator rubber, in a certain case, = 170,000 $(1 - 0{\cdot}003\,t)$ volts per cm., and, for jacket rubber, is 208,360 $(1 - 0{\cdot}008\,t)$ volts per cm.

Specific Inductive Capacity.—The following average values are stated :—

Rubber—pure ...	1·908	Tape	1·049
separator	3·722	Braid	1·309
jacket ...	2·758		

Practical Formulæ.—By substituting average values for electrical and thermal constants in the general theoretical formulæ, approximate practical formulæ are evolved for :—Temperature rise at any point in the covering of the conductor ; insulation resistance ; and breakdown voltage. These formulæ are derived for various covering materials and for wires carrying and not carrying current. Very fair agreement is shown between data calculated from these formulæ and data determined by experiment, and from the new formulæ it follows that a No. 20 S.W.G. wire will carry 10 or 11 amperes ; a No. 8 S.W.G. wire about 75 amperes ; and a No. 0 S.W.G. wire 195-200 amperes, if insulated with Tokio-Sen or the high or low grade insulations mentioned above. These ratings assume 20° C. temperature rise (15° to 35° C.), and at the higher temperature the insulation resistance is in each case approximately one-third or one-fourth as great as at the lower temperature. The author suggests that the current-carrying capacity of insulated conductors be determined by the deterioration in their insulation due to heating, and in this connection his formulæ are readily applicable to determination of the current corresponding to any specified decrement in insulation resistance. Actually, however, there would be excessive pressure drop in conductors rated simply by the 20° C. heating limitation. Only short circuits could be thus operated, and in few cases would mechanical considerations and the actual current to be transmitted enable full advantage to be taken of the thermal rating suggested.

* T. Hirobe, Report No, 12 of third Section.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

War and Science.

I do not know whether you are indeed desirous of arriving at the truth of the matter treated in your leader "War, and the Neutrality of Science" to such an extent as to give me, an American citizen of Austrian birth, an opportunity to reply thereto.

I do not think you will find a single German scientist of any importance who will not agree with you on the international nature of science.

As for the utterance ascribed to Dr. Lenard, if, indeed, it is a matter of positive utterance, it seems to me that your leader does not consider it quite fairly. On page 453, your correspondent, Mr. A. A. Campbell Swinton, includes the following passage in the alleged statement of Dr. Lenard :—

"The spirit of these great men has long ago passed into the souls of the living—and more so in those countries which England is trying to put down than in England itself."

The honest assumption of this being the case—which matter only history will be able to decide—justifies the hard judgment, the harshness of which is, of course, psychologically explained by the present conditions. These explain also the fervent patriotism which unites Germany and Austria to-day.

Science, as you will grant, has made such tremendous strides in Germany during the last hundred years, that to accuse the leading intellects of this nation of a sudden loss of their reasoning powers would be equal to more than rashness. . . . May I remind you also that German scientists have again and again stood unwaveringly for universal and humane rights, have battled for political freedom as well as freedom of thought. Cool deliberation—perhaps it is unfair to demand it of anybody to-day—must convince anyone that men like Haeckel and Hauptmann (to name leaders in two intellectual directions), cannot possibly be scared so as to fall in line with autocratic dicta after having opposed such bravely all their lives. To such men cool deliberation must concede—if *vox populi* does not prove anything, in your opinion—as much courage and brain power as any men in similar lines on the side of England and the Allies.

Permit me a few more words. You seem to consider the writings of Treitschke, Nietzsche and Bernhardi as responsible for the thought of Germany of to-day. This is rather like blaming the rainbow for the rain. These three writers are all esteemed by only a very, very small part of the German people and even intelligence. Nietzsche is a past issue, Treitschke and Bernhardi are largely the exponents of class interests foreign to those of Germany's and Austria's peoples. Prussian militarism has never had the sympathy of the majority in either of the two empires, but because its interests to-day are entirely in parallel with those of the great working class in both countries, it has the undivided support of these people. Even a year ago, the military budget in Germany was passed only with the greatest difficulty, and in Austria the Reichsrath was dissolved because of anticipation of such difficulties. But, as I said, the monarchy in Germany has assisted for the past 20 years in rendering the position of the worker better and more secure, and supporting his rights against the encroachments of his bosses; and the German people know just what good and what bad there is for him in this militarism, peaceful as the nation is. If English intentions were so friendly to the German people as is generally professed, Russian armaments would not have been furthered as they were, from Paris and London, for the preparation of a war which must necessarily decimate the German nation, no matter what the outcome of the present struggle might be. Trust the Germans to rid themselves of any overlords they don't want and have no use for, monarchy or "Grosskapitalismus," just as they managed to free themselves, and, moreover, Europe from the formerly indefatigable yoke of Rome.

As I read this over, I grow more and more convinced that it would be to expect not only fairness—an unfair expectation in itself at such a time as the present—but also bravery, should I hope for these lines to be published. But even if this cannot be done, I shall send this letter, knowing as I do by experience the fairness of the individual Englishman in his innermost reasoning and judgment, even when his thoughts are not given public expression for some reason or other.

Hans W. Weysz.

New York, *October 19th*, 1914.

Cable Censorship.

We regret to observe an editorial in your issue of October 16th containing a severe criticism of this company on account of an alleged protest by the Commercial Cable Co. against British censorship. This editorial is apparently based on a misunderstanding by you of our letter of August 20th, also printed in your edition of October 16th, on page 529. If you will refer to this letter you will observe that our protest was against the proposed censorship by the United States Government of trans-Atlantic messages, and had no reference whatever to the censorship of the British Government. As there was no ground whatever for your criticism, we trust you will at least give as much attention to correcting the mistake.

Fredk. Ward,
Manager in England, Commercial Cable Co.

London, E.C., *October 29th*, 1914.

[We fully understood that the censorship in question was that imposed by the United States Government, and we pointed out that, as a company registered in the United Kingdom, the company had incurred obligations to this country which could not be ignored. That the United States Government, in instituting the censorship, was acting in accordance with the wishes of the British Government cannot be doubted, and in opposing it the company was acting in opposition to British interests.—EDS. ELEC. REV.]

Who Can Help?

Please accept my best thanks for having given publicity to the matter of the young Belgian refugee. I am glad to say that I received two very generous offers of help, and that the refugee leaves here to-morrow to take up his new work feeling very grateful for the assistance given him. The local Belgian relief fund has been drawn on for his expenses.

Again thanking you for the part you have taken in bringing about such a satisfactory result.

L. W. Woodman,
Borough Electrical Engineer.

Dover, *October 29th*, 1914.

[We are glad to know that the refugee has been satisfactorily provided with employment. We also have a similar case on hand, and shall be glad to hear of any opening for a graduate of Brussels University, who has had considerable commercial experience.—EDS. ELEC. REV.]

Capturing German Trade.

Mr. E. J. Fox's letter in your October 2nd issue on the above subject voices the views of this writer and a good many others, no doubt, with respect to the necessity of something more permanent than war sentiment to aid domestic manufacturers to hold business against German competition after the war is over.

Only recently engineers connected with Corporations round London have frankly admitted to the writer that they would be buying German electrical goods as soon as the war was over, pointing out that the Corporation regulations, requiring them to purchase from the lowest bidder, compelled them to buy German goods in numerous cases. It would seem, as Mr. Fox states, that the country needs to adopt some commercial policy to offer protection to domestic manufacturers as a means of inducing capital to flow freely into line for the development of new enterprises and the extension of present industries.

Atlantic.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

21,157. "Points, switches, and the like of tracks for electrically-driven vehicles." R. CUMMING. October 19th

21,175. "Electric switches." J. H. TUCKER & J. A. CRABTREE. October 19th.

21,184. "Electrical pressing-irons." A. E. REIMERS & F. F. KIEFER. October 19th. (Complete.)

21,185. "Telegramophone microphone." V. B. KRAGH & A. MEYER. October 19th. (Convention date, October 16th, 1913, Denmark.) (Complete.)

21,189. "Method of influencing the electrical charge of a diaphragm." GES. FUR ELEKTRO-OSMOSE M.B.H. October 19th. (Convention date, November 6th, 1913, Germany.) (Complete.)

21,190. "Treatment of materials for impregnating them electro-osmotically." GES. FUR ELEKTRO-OSMOSE M.B.H. October 19th. (Addition to 19,849/14. Convention date, January 7th, 1914, Germany.) (Complete.)

21,206. "Process for the manufacture of metallic powders." S. O. COWPER-COLES. October 19th.

21,264. "Cold moulding or phenolic condensation products." E. HEMMING & HEMMING MANUFACTURING CO. October 20th. (Complete.)

21,266. "Telephone systems." E. G. GODFREE. October 20th.

21,302. "Dynamos." H. LEITNER. October 21st.

21,338. "Telephone systems." A. B. SMITH. October 21st. (Convention date, October 22nd, 1913, United States) (Complete.)

21,354. "Magnetic clutches." M. WALKER. October 22nd.

21,368. "Contact breakers or interrupters." G. F. COOK. October 22nd.

21,375. "Electrical inspection lamps and other kinds of lamps." W. E. HALLADAY. October 22nd.

21,388. "Wireless signalling systems." BRITISH THOMSON-HOUSTON CO., LTD. October 22nd. (General Electric Co., United States.)

21,389. "X-ray devices." BRITISH THOMSON-HOUSTON CO., LTD. October 22nd. (General Electric Co., United States.)

21,397. "Electricity meters." F. GARCIA & F. DE DIEGO (trading as Soc. Colectiva F. de Diego y Garcia). October 22nd. (Complete.)

21,411. "Magnetic compasses." G. A. GROVE. October 23rd.

21,435. "Electric incandescent lamps." BRITISH THOMSON-HOUSTON CO., LTD. October 23rd. (General Electric Co., United States.)

21,448. "Process for purifying and separating the constituents of glue, gelatine, or bodies like glue, or containing glue, with the aid of electric current." GES. FUR ELEKTRO-OSMOSE M.B.H. October 23rd. (Convention date, March 2nd, 1914, Germany.) (Complete.)

21,449. "Semi-automatic telephone systems." BETULANDER AUTOMATIC TELEPHONE CO., LTD., W. AITKEN & D. C. CROWE. October 23rd.

21,450. "Semi-automatic telephone systems." BETULANDER AUTOMATIC TELEPHONE CO., LTD., W. AITKEN & D. C. CROWE. October 23rd.

21,474. "Receiving arrangements for wireless telegraphy." T. W. STRATFORD-ANDREWS & A. ORLING. October 24th.

21,482. "Electrical insulation of track rails." C. P. SANDBERG. October 24th.

21,483. "Process for purifying bodies which yield glue or gelatine." GES. FUR ELEKTRO-OSMOSE M.B.H. October 24th. (Addition to 21,448/14. Convention date, March 2nd, 1914, Germany.) (Complete.)

21,484. "Process for the manufacture of gelatine suitable for photographic emulsions." GES. FUR ELEKTRO-OSMOSE M.B.H. October 24th. (Addition to 21,448/14. Convention date, March 2nd, 1914, Germany.)

21,488. "Automatic cut-outs for electrical installations." A. H. MIDGLEY & C. A. VANDERVELL. October 24th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

19,109. PLATES FOR ELECTRICAL OR SECONDARY BATTERIES OR ACCUMULATORS. E. Hancock & D. David. August 22nd.

19,919. ELECTRICAL TRANSFORMERS. F. Coates, J. Mirrey & A. Reyrolle & Co. September 3rd.

21,672. CONNECTIONS OF ELECTRICAL CONDENSERS. Marconi's Wireless Telegraph Co. & R. N. Vyvyan. September 25th.

22,406. TELEPHONE HAND SETS. Western Electric Co., G. H. Nash & B. B. Grace. October 4th.

22,416. ELECTRIC WATER HEATING AND SUPPLY APPARATUS. A. F. Berry. October 4th.

22,544. MANUFACTURE OF RESINOUS CONDENSATION PRODUCTS. British Thomson-Houston Co. (General Electric Co.). October 6th.

23,030. APPARATUS FOR DISPLAYING ANNOUNCEMENTS, ADVERTISEMENTS, AND THE LIKE. A. B. D. Lang & J. A. Powell. October 13th. (Cognate application, 28,040/13.)

23,117. MEANS FOR MEASURING, INDICATING, OR RECORDING FORCE AT A DISTANCE. H. S. Hele-Shaw. October 13th.

24,688. DEMAGNETIZING SWITCHES FOR USE IN MAGNETIC CHUCKS AND THE LIKE. T. L. Jones. October 30th.

25,607. PLATES OR ELECTRODES FOR SECONDARY BATTERIES. E. H. Naylor. November 8th.

27,582. ELECTRIC ARC LAMPS. A. H. Railing & A. E. Angold. December 1st.

29,581. ELECTRIC BELLS. W. J. Blenheim. December 23rd. (Cognate application 6982/14.)